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MARCH, 1897. VOL. IX. No. 3.

The Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

SUMMARY OF CONTENTS.

(For Details, see over.)

	PAGE
The Nansen Meeting in the Albert Hall	249
Explorations in Mysia. By J. A. R. MUNRO and H. M. ANTHONY	256
Geographical Work of the Geological Survey of Canada, 1896. By Dr. GEORGE M. DAWSON, C.M.G., F.R.S.	276
On the Formation of Sand-Dunes. By VAUGHAN CORNISH, M.Sc. (Vict. Univ.), F.C.S., F.R.G.S., Associate of the Owens College, Manchester	278
Ancient Trading Centres of the Persian Gulf	309
Egypt and Abyssinia. By Professor LEO REINISCH	314
The Monthly Record	318
Correspondence	331
Obituary	331
Meetings of the Royal Geographical Society, Session 1896-97	333
Geographical Literature of the Month	334
New Maps	349
Maps and Illustrations.	

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For Notices as to the Society's Meetings and other important matters, see p. iv.

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The Geographical Journal.

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CONTENTS.—MARCH.

PAGE

The Nansen Meeting in the Albert Hall 249
Explorations in Mysia. By J. A. R. Munro and H. M. Anthony 256
Geographical Work of the Survey of Canada, 1896. By Dr G. M. Dawson, C.M.G., F.R.S. 276
On the Formation of Sand-Dunes. By Vaughan Cornish, M.Sc. (Vict. Univ.), F.C.S. . 278
Ancient Trading Centres of the Persian Gulf 309
Egypt and Abyssinia. By Professor Leo Reinisch 314
The Monthly Record 318

EUROPE
The River System and Watercourses of Switzerland
Explorations in North-Eastern Iceland
Germans in Hungary
Germany—New Geographical Society
Explorations in Cerigo and Cerigotto

ASIA
Sir George Robertson on Kafiristan
The Andaman and Nicobar Islands
The Tsangpo of Tibet
Journey through Syria to Asia Minor
The Russian Fur-Seal Islands

AFRICA
Miss Kingsley on West Africa
Two Historical Books on S.-E. Africa

AFRICA—*continued.*
Mr. Weatherley's Survey of Lake Bangweolo
M. Versepuy's Journey across Africa
Captain Ramsay on Ujiji and Tanganyika
Steam Transport in German East Africa
New Project for a French Niger Railway
Positions fixed by M. Foureau in the Northern Sahara

AMERICA
The Headwaters of the Missouri

AUSTRALASIA
New Zealand Alps

GENERAL
Mr. Hogarth's Travels in the Levant
Sir Joseph Banks's Journal
Death of S. S. Rogozinski

Correspondence—Popocatepetl. By O. H. Howarth 331
Obituary—Frederick J. Mouat, M.D., LL.D. Sir J. B. Thurston, K.C.M.G. Admiral Sir Alexander Milne, G.C.B. John Lowe Nicholl 331
Meetings of the Royal Geographical Society, Session 1896-97 333
Geographical Literature of the Month 334
New Maps 349

MAPS AND ILLUSTRATIONS.

Fridtjof Nansen . . . . . *Frontispiece*
The Nansen Medal . . . . . *Fronting p.* 252
Colin Archer, Builder of the *Fram* 250
Captain Otto Sverdrup 251
Lieutenant Sigurd Scott-Hansen 252
Dr. Henrik Blessing 253
Lieutenant Hjalmar Johansen 254
Emed 261
Valley of Sinjan Chai 267
Eyrigenz 271
Profile of Wind-formed Ripples, First Approximation 280
Water-formed Ripple Mark under Current Action, showing Stream-Lines 281
Profile of Wind-formed Ripples, Second Approximation 281
Profile of a Group of Wind-Formed Ripples isolated upon a Hard Bed 282
The Coalescence of Ripples 283
Ripple Structure homologous with "Fuljes" . . 284
The First Effect of Reversed Wind, turning the Top of the Dune 286
The Shortest and Closest (Artificial) Sand-Hills . 287
The Shortest and Closest Dunes (subject to Reversible Wind) 287
Degraded Form of Dunes subject to Reversible Wind 288
Cross-Section of Dunes with Flanks scoured by Wind 288
Barchane of the Sahara 289
Barchane, after Exposure to Wind in a Failing Sand Shower 291
Stationary Conical Dune of the Sahara, height 52 Metres 292
Longitudinal Dunes of the Indian Desert . . . 293
Transverse Dunes of the Indian Desert 294
Dunes of the Indian Desert intermediate between the Longitudinal and Transverse Types . . 295
Fuljes of the Arabian Nefúd 296
Dr. Euting's Hypothetical Profile of Contiguous Fuljes 297
Small Dunes at the Steep End of the Fuljes . . 297
Effect of a Wall upon the Course of the Wind . 298
Encroaching Sand, Egypt. Date Palms being smothered 299
Effect of Gouging and Tossing Action of Eddies near a Hard Elastic Obstacle 299
Deposit of Blown Sand in a Transverse Valley . 300
Upper part Moving Dune; lower part Fixed Dune (Egypt) 301

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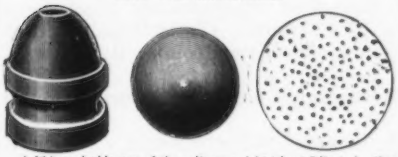

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Tickets for the lessons must be previously procured at the Offices of the Society where information as to fees, etc., may be obtained.

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Evening Meetings.—Papers to be read at the Evening Meetings in March:—**Monday, March 8.** Recent Explorations to the South of Hudson's Bay. By Dr. Robert Bell, of the Canadian Survey. **Monday, March 22.** Some Consideration on Polar Exploration. By the President.

Afternoon Meeting.—Wednesday, March 17, at 5 p.m., at 1, Savile Row. Terrestrial Magnetism, with special reference to the position of the Magnetic Poles. By E. A. Reeves, F.R.A.S.

Educational Lectures.—Under the joint auspices of the Society and the London University Extension, Mr. H. J. Mackinder, M.A., is giving a course of twenty-five lectures on the Geography of Europe, Asia, and Northern Africa, in illustration the Methods and Principles of Modern Geography, at Gresham College, Basinghall Street, E.C., on successive Mondays at 6 p.m., beginning January 18. To these lectures Fellows are admitted free on showing their tickets.

Any Fellow resident in this country, desiring to have notice of the subjects of papers to be read at the Society's Meetings forwarded to him, can receive such notices by post on payment in advance to the Chief Clerk, at 1, Savile Row, of 2*s.* per session.

The Society's House will remain open for the Convenience of Fellows on the evenings of the Society's ordinary meetings till 8.15.

NOTICE TO FELLOWS.

Election of Council.—In accordance with the resolution of the Council of November 10, 1891, it is herewith notified that "any names of persons qualified to fill the vacancies occurring on the Council, with their qualifications, suggested in writing to the Secretaries before the first of May by Fellows, will be considered by the Council in drawing up the Balloting List" for the next Annual Meeting.

Photograph by Nyblin, Christiania, 1896. *Swan Electric Engraving Co.*

Fridtjof Nansen

The
Geographical Journal.

No. 3. MARCH, 1897. Vol. IX.

THE NANSEN MEETING IN THE ALBERT HALL.

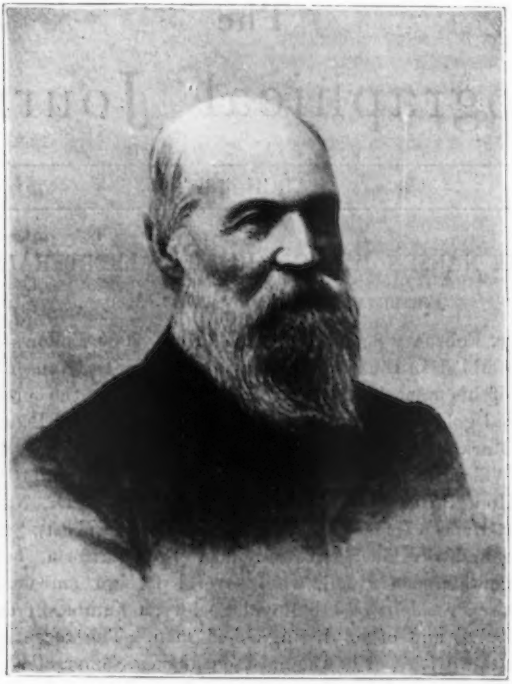
Presentation of the Special Medal.

On Monday, February 8, an audience of about 7000 Fellows and their friends assembled in the Albert Hall, to welcome Dr. Nansen, listen to the story of his remarkable enterprise, and witness the presentation of the special gold medal awarded by the Council. The President, Sir Clements Markham, K.C.B., occupied the chair. On his right was the Prince of Wales, Vice-Patron of the Society; and on his left the Duke of York, Hon. President. At the table were seated Dr. Nansen and Lieut. Scott-Hansen (one of the scientific staff of the *Fram*), Sir Leopold M'Clintock, and Sir George Nares. On the platform, besides the Vice-Presidents and Council, were several foreign ambassadors and ministers, the President of the Royal Society, a number of the British arctic explorers, and other distinguished men. The reception which Dr. Nansen met with was of the most enthusiastic character. He held the close attention of the audience for nearly an hour and a half, while he told, without the assistance of manuscript, his story of the *Fram* and of the venture of himself and Lieut. Johansen. The story was illustrated with a series of about fifty slides projected on the screen, partly from photographs and partly from Dr. Nansen's own coloured sketches. They were admirably executed, clear, and effective, and illustrated in a striking manner the scenes in the midst of which the expedition spent three years, and some of the incidents that occurred. The address was listened to with the closest attention, and enthusiastically applauded. As it was the lecture which Dr. Nansen is delivering over the Kingdom during February and March, we do not publish it here. In an early number of the *Journal* an account of some of the scientific results of

the expedition, specially prepared by Dr. Nansen for the Society, will be published, with maps and illustrations.

The President introduced Dr. Nansen as follows:—

"Your Royal Highnesses, Fellows of the Society, and Guests. The minutes of the last meeting will not be read: the list of Fellows elected to-day will be read another time, and I trust these irregularities will be excused. The thousands of guests who have honoured us by



COLIN ARCHER, BUILDER OF THE *FRAM*.

(*From "Farthest North," by permission of Messrs. A. Constable & Co.*)

accepting our invitation for this meeting, combined with ourselves, form a vast assembly. The presence of such an assembly is a proof, if proof were needed, of the great interest which is taken by all Britons in the magnificent geographical achievement of our Norwegian colleague and gold medallist. Nansen is an old friend. He was with us after he returned from his splendid Greenland exploit; he was with us when he came to tell us his plans for exploring the unknown region. This Society wished him a hearty God-speed, and I for one never doubted that he would return, and that he would return successful.

His great ability and resourcefulness, his great scientific knowledge, his marvellous powers of endurance, above all, those high qualities by which he made himself loved by all his followers, were the guarantees of that success. We shall often think of these guarantees as we listen to what the great explorer is about to tell us. I call upon Dr. Nansen to address the meeting."

After the address :—

Admiral Sir LEOPOLD M'CLINTOCK said : "Your Royal Highnesses, Mr.

CAPTAIN OTTO SVERDRUP.

(From a photograph by Szacinski, Christiania.)

President, my lords, ladies, and gentlemen,—As one of the senior arctic officers of this country, I have been entrusted by his Royal Highness the Prince of Wales, with the honour of proposing a vote of thanks to Dr. Nansen, and in so doing I am but the mouthpiece of this vast assembly to give expression to the great interest and admiration with which they have listened to his marvellous lecture; and, although all must admire, only we arctic men who have experienced the hardships of

that peculiar service can thoroughly appreciate the magnificent courage and endurance of Nansen and his companions, and we arctic men are so favourably impressed by Nansen's genius and fortitude that we have determined to give expression to our high approval and admiration in the shape of a special presentation. Your Royal Highness, I beg to propose that we offer our very best thanks to Dr. Nansen for the address which he has delivered."

Admiral Sir GEORGE NARES said: "I have the greatest pleasure in

LIEUTENANT SIGURD SCOTT-HANSEN.
(From a photograph by Szacinski, Christiania.)

seconding the vote of thanks to Dr. Nansen for his so very modestly related story of the experiences, privations, and dangers undergone by himself and his companions during the daring and adventurous voyage of the *Fram*.

"In successfully drifting across the Arctic Sea with the vessel frozen in the ice in so short a time, Dr. Nansen has satisfactorily proved that his bold idea of so continuing polar exploration, which received our outspoken but friendly criticism a little more than four years ago,

was thoroughly well conceived in every respect. The facts which he has established, as to the northern termination of Franz Josef Land, the great depth of the Arctic Sea, and that the ice in this part, instead of being of a solid and palæocrystic character some 100 feet in thickness, as we had reason to expect, cannot be more than some four or five years old, the time taken to drift across from one side to the other, are of the greatest importance in connection with further exploration.

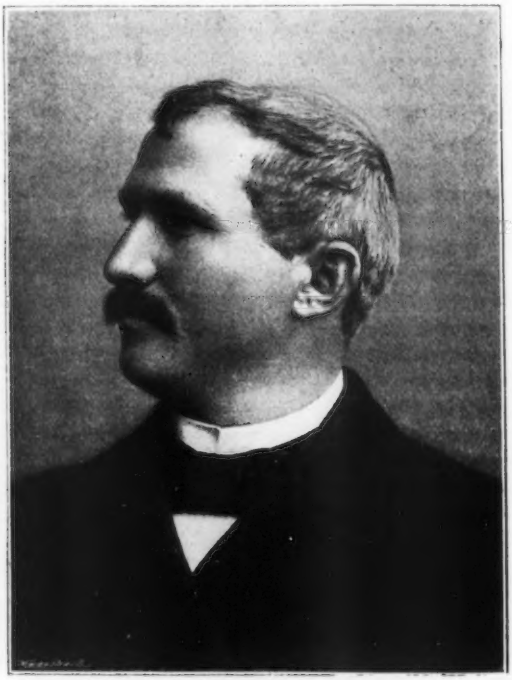
DR. HENRIK BLESSING.

(*From a photograph by Szacinski, Christiania.*)

"Having assured himself that the *Fram* was drifting steadily homeward, Nansen's decision to leave her comfortable quarters and make a dash for the pole, with Johansen as his sole companion, having Spitzbergen and Franz Josef Land as their only base, is far and away the most remarkable display of plucky self-confidence in arctic records. The conception of so unprecedented a journey can only be compared with that of his own previous trip across Greenland in 1888, when he practically burnt his boats behind him, and, with no possible means of

retreat, successfully completed his journey by ever pushing boldly forward.

"Their Eskimo-like life for so many months on their retreat to Franz Josef Land, subsisting on their own resources somehow or other, in the manner he has related to us, is a most wonderful achievement, and the literally true story of this fine display of manhood, obstinate tenacity of purpose, and readiness of resource under the most extreme circumstances will be, we may be sure, for ages to come, a favourite and



LIEUTENANT HJALMAR JOHANSEN.

(*From a photograph by Szacinski, Christiania.*)

valuable gift-book to the rising generations. We may truly say of Nansen, 'None but himself could be his parallel.'

"It is very evident, from the accounts that we have received, that the officers and crew of the *Fram* were worthy of their leader. Owing to their nearness to the pole, their winters were longer and darker than ever before experienced by man. The fact of being out of sight of land throughout their three years must have been, to a certain extent, depressing; but, on the other hand, the fairly continuous drift of the ice-

SPECIAL MEDAL AWARDED BY

THE ROYAL GEOGRAPHICAL SOCIETY TO

DR. NANSEN.

bound vessel in a homeward direction must have exercised a very cheering effect on one and all.

"As Sir Leopold M'Clintock has stated, all the British arctic explorers join in heartily congratulating Dr. Nansen and his shipmates on their brilliantly successful voyage, by means of which, in addition to their having reached within 226 miles of the pole, 170 miles nearer than any former travellers, our knowledge of the polar regions has been vastly increased."

The PRESIDENT: "It has been proposed by Sir Leopold M'Clintock, and seconded by Sir George Nares, that a cordial vote of thanks be passed to Dr. Nansen for his paper, and that will be carried by acclamation."

The vote was carried by acclamation, after which his Royal Highness the PRINCE OF WALES said:—

"Mr. President, ladies and gentlemen, what has fallen from the lips of Sir Leopold M'Clintock and Sir George Nares in moving and seconding the vote of thanks to Dr. Nansen, leaves me very little to say but entirely to endorse all that has fallen from them. We are, I think, highly indebted to Dr. Nansen for having given us such an instructive and interesting narrative of his adventures on this arctic exploration, and my only regret was that it was not longer; but it must have been a severe tax upon him to describe, in a language which is not his own, so admirably, and in many instances so graphically, the incidents which occurred to him during these many months on the ice. These descriptions have also been greatly enhanced by the fine photographs we have seen to-night. For my own part, I must congratulate you, Dr. Nansen, on having returned to your native land, and on having paid us another visit. I had the advantage of seeing you on a previous occasion, and it is now my high privilege to have been asked by the Council of the Royal Geographical Society to give you, in the name of the Society, a special gold medal, which has been struck to commemorate your achievement. You have already in your possession the Patron's Medal, which was awarded to you five years ago; this is one specially struck for you, and I am sure it is one you will appreciate and value in the years to come. Allow me to present it to you."

Dr. NANSEN said: "I beg to thank you most sincerely, deeply, and warmly for the exceptional honour which has been bestowed on me and my expedition. It is so much dearer to me coming from this nation, and from this Society, which has counted among its members the most prominent, the most distinguished, and most enterprising explorers that the world has ever seen; and it is so much more honouring, as it comes from a foreign nation. It shows the spirit of that nation, which has always taken the lead in all kinds of exploration. I need not say that it is an additional honour to receive this medal from your Royal Highness's hands."

The Prince of Wales then presented a silver medal to Lieut. Scott-Hansen, who expressed his thanks to the Society for it.

The PRESIDENT said: "We have to thank his Royal Highness for having come to give the medal to Dr. Nansen; and also his Royal Highness the Duke of York, for honouring the Society with his presence."

Silver medals will be sent to Mr. Colin Archer, the builder of the *Fram*, Captain Sverdrup, Dr. Blessing, and Lieut. Johansen, and bronze medals to the rest of Dr. Nansen's comrades.

A representation of the special medal accompanies this notice, together with the portraits of Dr. Nansen, Mr. Colin Archer, Captain Sverdrup, and those who were specially concerned in the scientific observations on board the *Fram*. The presentation to Dr. Nansen, to which Sir Leopold M'Clintock referred, has taken the form of a specially bound set of British Arctic voyages, to which only those who have themselves spent at least one winter in the arctic regions have been allowed to contribute.

EXPLORATIONS IN MYSIA.*

By J. A. R. MUNRO and H. M. ANTHONY.

Our journey up the Rhyndacus brought us to Tavshanli, a considerable town about eight hours west of Kutaya, and the same distance north or north-west of Azani. Now, Sir Charles Wilson states that "Tavshanli was of importance during the early Turkish period as a station on the great road from Kutaya by Balat and Balikisri to the Dardanelles and Gallipoli."† This statement at first puzzled me, for, owing to the error in Kiepert's map, whereby the Egriguz Dagh and the Emed district are thrust too far to the south, I did not at once recognize this road to be the same as that which we followed from Tavshanli as far as Sulya on our way to Emed. It can scarcely be called a great road at the present day, but it is quite easy, at least as far as Sulya. We must have crossed it at Balat, but in the dark; and again we crossed it in the Macestus valley about 6 miles south of Kebsud. A castle on a steep spur above the left bank of the Macestus commanded the passage of the river. From Balukiser there is a direct continuation of this road westwards through Balia to the head of the Æsepus, and thence over the watershed and down the Scamander to the Troad. The road, so far as I can see, presents no great difficulty. Its existence in ancient times would furnish a welcome explanation of several obscure points: (1) The order of Hierocles' enumeration—Ilium, Troas, Scamandrus, Polichna, Pœmanenum—suggests a road. (2) An inscription of Novum Ilium‡ records that a garrison from Pœmanenum was sent to defend the town in 80 B.C. This fact seems

* Continued from p. 168. Map, p. 248.

† 'Handbook to Asia Minor,' p. 59.

‡ Published in Schliemann's 'Ilios,' p. 636.

to indicate some fairly direct communication between the two places. (3) Aristides *drives* from his paternal estate through Pœmanenum to the hot springs on the Æsepus. The road is in bad condition after rain, but it is a road practicable for wheeled traffic. (4) This road would explain the movements of the Turkish division under Mahumet in the year 1113.* As has been already mentioned in connection with Lentiana,† the Turks divided near Lopadium, and, while the one half took the outer circle round the coast to Adramyttium and thence up the Caicus, Mahumet's division kept inland by Lentiana to Pœmanenum. Alexius, on hearing the news, dispatched Camytzes from Nicæa in pursuit. He fell in with Mahumet at Aorata, fell upon him, and dispersed his force, but omitted to push on to Pœmanenum, where he would have been secure. The Turks rally in a plain beneath Aorata, defeat Camytzes, and take him prisoner. Both Turkish divisions are making homewards towards Dorylaium, for the emperor, advancing through Malagena, cuts off their retreat in that region. It is natural to suppose that they wheeled round on parallel curves: the one through the Troad and Adramyttium, the other through Pœmanenum and Hadrianutheræ, *i.e.* on the road we have been discussing. Camytzes would march by Lopadium and the Macestus. I venture to suggest that Aorata is the castle which guards the passage of the river on the Balat road. The situation admirably corresponds with the description. (5) Next to Pœmanenum Hierocles mentions Artemea. Mr. Ramsay‡ has very plausibly identified Artemea with the hot springs on the Æsepus, which were sacred to Artemis Thermæa.§ In his latest work, 'St. Paul the Traveller and the Roman Citizen,' he brings St. Paul to Artemea on his journey to Alexandria Troas after he had been prevented from entering Bithynia. "A tradition that Paul had travelled by the sacred town of the goddess Artemis at the hot springs of the river Aisepos can be traced as early as the second century, accompanied with the legend that he had founded a chapel in the neighbourhood."‖ Mr. Ramsay, with whom I entirely agree as to the general course of this journey, takes St. Paul down the Rhyndacus, south of Lake Manias to Gunen, and round by the coast road to Alexandria Troas. The first part of this route is very difficult, the second part is very circuitous. If the road by Balat, Balukiser, Balia, and the Scamander be admitted, it offers an easier and a very much more direct route to St. Paul's destination; indeed, this road is almost a straight line from Cotyaium to Alexandria Troas, and it leads right past the hot springs on the Æsepus at Khydyrlar.

The force of these various considerations is cumulative. They all

* Anna Commena, 'Alex.,' XIV. 5. Compare Ramsay, 'Hist. Geogr.,' p. 208.
† Above, p. 161.
‡ 'Hist. Geogr.,' p. 154.
§ Aristides, ed. Dindorf, vol. i. p. 503.
‖ P. 197. The authority is not quoted.

tend to confirm, firstly, the existence of the road from east to west; and, secondly, the position assigned to Pœmanenum and the hot springs of Artemea. Against them may be set the vague statement of Nicetas,* that a division of Franks, marching from Pegæ to Lopadium, was encountered by Theodore Lascaris, περὶ τὸ λεγόμενον Ποιμανινόν. I take this expression, which in any case cannot be pressed, to mean "at the junction of the road from Pœmanenum with the coast road."

We now return to the Macestus valley. North of the Demir Kapu pass a road forks from the Balukiser *chaussée*, and keeps away to the east of it to Kebsud and Bigadich. This road, now comparatively little used, was once important as the main route from Lopadium to the upper Caicus and Hermus valleys. From Maje, on the hills east of Kebsud, we had a good view of it winding down the slopes of the Yilanli Dagh; but it was at Kebsud that we first came upon it. The town lies on a tributary of the Macestus which flows parallel to the main river, separated only by a low rise. Several inscribed bases, some carved stones from a church at one of the mosques, and a field of shapeless rubble-and-concrete ruins on the south side of the town, indicate the neighbourhood of an ancient site, but its name cannot be determined. The road continues southwards through bare arid country, first up the Kebsud stream; then, after crossing the ridge to Kalburja, up the Macestus valley to Bigadich. It is easy, but uninteresting.

Bigadich, or Bogadich, lies at the foot of a hill overlooking a small plain, which opens from the right bank of the Macestus. It is a fairly busy place, with some show of a bazar. A good deal of cotton and opium is grown on the plain, but the chief industry appears to be tanning. Here the road divides. One branch continues southwards over rocky hills to Sinjerli, where it forks again to Simav and to Ak Hissar (Thyatira); the other bears away to the west of the Macestus, over bare uplands to the upper Caicus valley. This is an easy although now little frequented road. It leads in eight hours by Gyuljuk and Chobanlar to Gelembe. There are also roads from Bigadich to Balukiser and Balat.

The acropolis of Bigadich has been crowned by a fortress of great extent and strength, the massive external walls of which are still standing. This fortress must have been the largest and most important in the whole Macestus valley. Now, the most important stronghold on the road from Lopadium to the Caicus and Hermus valleys was the fortress of Achyraous, or Ochyræ, built, according to Nicetas,† by the emperor John Comnenus, and often mentioned in the Byzantine wars. Achyraous cannot have been very far from Hadrianutheræ, for the two are combined in one bishopric in the later Notitiæ.‡ Its situation may

* Nic. Chon., "Post captam urbem," 8. † Nic. Chon., P. 22 B.

‡ See Ramsay, 'Hist. Geogr.,' p. 156.

be more precisely determined from the terms of the treaty between Theodore Lascaris and the Franks.* The latter were to hold Achyraous; Calamus, the frontier village of the theme of Neocastra, was to remain unoccupied; Theodore was to have everything south of Calamus and east of Lopadium. It is clear that the frontiers were drawn practically along the valleys of the Macestus and the Caicus, and that Achyraous was the extreme south-eastern point of the Frankish territory. Calamus, or Calanta, was close to Stratonicæa† (Silerik), and the road from the upper Caicus to the Macestus valley lay through Calamus and over hills to Achyraous.‡ This road corresponds to the road from Gelembe to Bigadich, and the great fortress at Bigadich to Achyraous. The roads from the north and the roads from the south are focussed at Bigadich, which would also be the meeting-point of the frontiers. I have little hesitation in identifying Achyraous with Bigadich, and (as the name alone might suggest) Calamus with Gelembe.

At Persi, a village about two hours to the north-west of Bigadich, on the other side of the Macestus, we discovered a very curious little rock-hewn church and hermit's cell. An isolated pinnacle of rock overlooking the valley has been entirely hollowed out. At the top is the hermit's cell, a simple square chamber with a stone bench along each side. Below is the church, which is very complete in all its details. It contains two rock-cut tombs, and the walls are decorated with rude carvings and remains of frescoes.§ The district of Ciminas, a mountain in the Frankish territory near Achyraous,‖ was a noted haunt of hermits.¶ Possibly Ciminas may be the conical hill now known as Sivri Tepe, which is a prominent landmark from the plain of Balukiser, and the cell at Persi may have harboured one of the hermits.

The lower Macestus flows from south to north. The upper Macestus (from its source to near Bigadich) flows at right angles to the lower course, from east to west. The lower Macestus valley is an important channel of communication between great centres of population, the plains of the Caicus and Hermus on the south, and the coasts of the Propontis and Constantinople on the north. The upper Macestus valley connects no great cities; at most it can only have been a little-frequented route between the Caicus valley at the one end, and Cotiaium and Dorylaium at the other. But from Pergamus and the western districts the road by Balukiser, Balat, and Tavshanli would probably be preferred. Consequently, few indications are to be discovered of the

* Georg. Acropol., 15. † See Ramsay, 'Hist. Geogr.,' pp. 129, 133.

‡ See the march of Frederick, quoted by Ramsay, pp. 129, 130, and Georg. Acropol., 87: *τοὺς τοῦ Καλάμου βουνοὺς παρημείψαμεν καὶ τῆς Ἀχυράους ἐγγὺς ὁ βασιλεὺς ἐπήξατο τὴν σκηνήν.*

§ Professor Anderson hopes shortly to publish an account of this interesting rock church, with plans and illustrations.

‖ Georg. Acropol., 15. ¶ Theoph. Contin., VI. 27.

existence of the upper Macestus road in ancient times. Mr. Ramsay can say with justice that "there is no evidence that a road Kotiaion—Aizanoi—Synaos—Ankyra—Makestos valley—Stratonikaia—Pergamos, was in use."* Yet of the three roads from east to west between Olympus and Temnus, the Rhyndacus road, the Balat road, and the Macestus road, this last is, I am sure, far the easiest. The only considerable difficulty is the pass over the Shabhane Dagh at the head of the valley, and this cannot be very serious, for it is proposed to extend the carriage road from Gediz over it to Simav. We may assume, without positive proof, that the road did exist in antiquity, and the assumption is in some cases convenient. The inhabitants of Mysia Abbaitis and Phrygia Epictetus combine to honour C. Salvius Naso with a common monument.† The term Abbaitis seems sometimes to include not only Ancyra and Synaus in the Macestus valley, but also Cadi (Gediz) to the east of the watershed.‡ Cadi and Azani on the one side are grouped together with Ancyra and Synaus on the other in one ecclesiastical district.§ These facts seem to point to some easy intercommunication. Again, Mr. Ramsay has himself very plausibly suggested that this was the road whereby the one division of the Turkish invaders in the year 1113 retired homewards, after marching round the coast of Troad and up the Caicus valley through Germe and Chliara.‖ I have sometimes thought that Attalus I. may have marched back by this road after his incursion into the territory of Achaeus in the year 218 B.C.¶ Attalus, who had been threatening the cities of Æolis, advanced across the Lycus against "the colonies of the Mysians," which I take to mean Seleucid military colonies of Mysian mercenaries north of the Hermus. Then he came to a place or people Carseis, and next to Didyma Teiche, which were surrendered to him by the officer left in command by Achæus. Thence he proceeded to ravage the plain of Apia, crossed over Mount Pelecas, and encamped by the river Megistus. Here his Gallic troops mutinied, and he had to lead them back to the Hellespont, whence he went home to Pergamus by the coast road through the Troad. If Apia were the place of that name south of Cotaium, and the Megistus the Macestus, one might say that Mount Pelecas is the Shabhane Dagh, and Attalus marched out eastwards on the south of Mounts Temnus and Dindymus, and back westwards on the north of them. But I am now inclined to believe that Attalus' campaign was of shorter range, and did not extend nearly so far to the east. He must, I think, have crossed the Lycus south of Thyatira,

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* 'Hist. Geogr,' p. 168, note.

† C.I.L., xiv. 2218.

‡ See an inscription in Le Bas and Waddington, No. 1001, and Strabo, 576.

§ See Ramsay, 'Hist. Geogr.,' p. 146.

‖ See above, p. 257, Anna Comnena, 'Alex.,' XIV. 5; and Ramsay, 'Hist. Geogr.,' p. 209.

¶ Polybius, V. 77. Mr. Ramsay informs me that M. Imhoof Blumer has a coin of Apia belonging to the time of the Seleucid kings.

and operated against the Seleucid colonies in that neighbourhood; then turned northwards or north-westwards to Carseis and Didyma Teiche, and struck the Macestus possibly near Sinjerli, with the intention of marching up it (προελθεῖν εἰς τὸ πρόσθεν = away from the Hellespont, c. 78). Carseis may be the Ceraseis of the Byzantines, which Mr. Ramsay takes as identical with Nacrasa.* The name is all over the district (Nacrasa, Acrasus, Gordus), and the ethnic form is significant. On this hypothesis Attalus intended to march eastwards up the Macestus, but was forced by his Gallic auxiliaries to march northwards down it.

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But where every point is so doubtful, it is perhaps vain to attempt a construction.

Of the upper Macestus between Bigadich and Assar Keui, west of Simav, we cannot speak from our own observation. We had a good view down its long straight valley from the latter point, and could plainly trace the line of its cleft from the vantage ground of the hills above Sinjerli on our way to Gelembe, but we had no time to explore it further. We did, however, visit the plain of Simav by the difficult mountain track from Assarlar, near Emed.

The situation of Simav is aptly compared by the Turks to that of Brusa. The town lies facing the north at the foot of the mountains,

* 'Hist. Geogr.,' pp. 125, 126. On the name Gordus compare Ramsay in 'The Cities and Bishopries of Phrygia,' vol. i., "The Lycos Valley," p. 249. I have had no opportunity of consulting M. Radet's recent discussion of Attalus' march in the 'Revue des universités du Midi.'

with the plain in front and the lake to the west. The abrupt wooded sides and bold outlines of the Temnus range form a fine background, but the lake at the end of the dry season is little better than a reedy marsh. The plain is well cultivated and dotted with trees, mostly walnuts. The northern hills are barer and less picturesque than the southern.

We rode round the north shore of the lake to Saüjilar, and from there made an excursion westwards as far as Assar Keui in the vain hope of hearing of ancient remains farther down the valley. There are a few inscriptions at Saüjilar and Baddelu and Assar Keui. Near this last village are two ruins, the one a large oblong enclosure in the plain, about 80 yards long by 50 broad; the other a castle, of which but slight traces remain, just outside the village. The village stands at the mouth of a wooded glen in the southern hills, and the castle must have defended the entrance and the hill-road over to Demirji.

Another road leaves the plain of Simav on the north side of the lake. It leads over a low easy *col* to the head of the westerly branch of the Egriguz Chai, which it follows down to Sinekler, and there strikes over the hills to Balat. But this road belongs to the Rhyndacus basin and the next section of our paper.

III.—The Hill Country between the Rhyndacus and the Macestus.

(By H. M. Anthony.)

1. *The Middle Rhyndacus.*

That part of the Rhyndacus which lies between Tavshanli and Kirmasti is to be distinguished on the one hand from the headwaters, and on the other from the lower reaches in the alluvial plains which lie to the south of the Sea of Marmara. The distance between these two points is about 65 miles as the crow flies. The general direction of the river valley is north-west. Shortly after passing Tavshanli the stream plunges into the midst of a hill country, from which it does not again emerge till Kirmasti is reached. On its northern bank lies the Olympus range. Its outlying spurs rise abruptly from the river valley, and are broken only by mountain glens, through which tributary streams hurry to join the main river. Behind this fringe of hills is to be seen the lofty ridge forming the actual Mount Olympus. This chain serves as a conspicuous landmark in all views from the south. Its gleaming crest of snow-white limestone towering above the sombre pine-covered shoulders can be clearly seen on the northern horizon from almost any elevated spot in the Rhyndacus basin.

On the southern bank of the river rises a confused mass of hills drained principally by the Egriguz Chai. Immediately to the south of the Rhyndacus their elevation appears to be less than that of the Olympus spurs, but the country ascends gradually to the south and

west, where the Bodaghan Dagh, Shabhane Dagh, Egriguz Dagh, and Sinjan Dagh rise to a considerable elevation above the high land forming the southern watershed. Like the southern slopes of Olympus, this country to the south of the river is for the most part forest covered. The hills are long continuous ridges, and their almost monotonous contours are only diversified by the more imposing outlines of the mountain masses mentioned above. Through this hill country the river has cut for itself a narrow and difficult path. Flowing now through a rugged defile, now through a valley, whose breadth rarely exceeds a mile and a half, only to plunge again into a gorge, it has deposited but little alluvial soil, and affords scant space for cultivation. Even below Kestelek, where the river has received the waters of its main tributary, the Egriguz Chai, and where it has turned northward to force its way through low hills into the plains, the breadth of the valley is hardly greater. The river itself has, however, greatly increased in size during its passage through the hill country. At Tavshanli the stream was in September about 20 yards across, the current slow, and the water hardly covered our horses' knees. At Kirmasti, where the river has driven its last gap through the hills, there is a bridge a hundred and forty paces from bank to bank, and though in August the stream did not cover the whole of its bed, it must have been 60 yards wide, strong and rapid. Throughout this part of its course the water is turbid, and of a greenish white hue, which reminds one strongly of the streams of the China-clay districts in Cornwall. In spite of the narrowness of the valley, the strips of alluvial soil along the river-banks are carefully tilled, and seem to bear good crops of cotton and maize. The lower slopes of the enclosing hills are dotted with clumps of trees, outposts of large forests covering the hill country, and present a park-like appearance. In the gorges the vegetation is wilder; the river is hidden in plane trees, amongst which the wild vine and the cornel tree grow in profusion. The steep parts are for the most part covered with scrub oak. Fortunately for the traveller, the lateral valleys often afford an easier route than the course of the main river. The ascents are gradual, and lie through more open country, much of which is under cultivation and supports numerous villages. At higher levels the track winds for hours through forests, principally of pine. Towards the more elevated ridges again the forest thins, and open ground occurs more frequently, scattered with rhododendron bushes and black juniper. Throughout this upland springs are plentiful and of excellent quality.

The roughness of the country renders it highly improbable that the Rhyndacus valley ever served as an important means of communication between north-west and central Asia Minor. From north to south the roads from Brusa and Isnik round the eastern shoulder of Olympus, and from Mikhalich and Cyzicus up the broader and less rugged valley of the lower Macestus, must have been preferred. From east to west the

road through Tavshanli, Balat, and Balukiser, and the road down the upper Macestus, are both of them incomparably easier thoroughfares. Still, the numerous castles, whose ruins mark the course of the middle Rhyndacus, point, if not to the existence of an important road, at least to the possibility of its proving a source of danger to the shores of the Marmara—a tempting pathway to the Seljuk invader.

2. *The Country between Brusa and Beyjik.*

The Olympus range forms the barrier which shuts off the valley of the middle Rhyndacus from the Marmara littoral. Close under its northern slope lies Brusa, the administrative and commercial centre of the vilayet of Khodavendikiar, and the starting-point of two roads by which the middle Rhyndacus may be reached. Of these one climbs the steep sides of the mountain immediately behind Brusa, and, taking a southerly course, crosses a little west of the highest point of the range. This route is more direct, but it is said to present great difficulties, and for pack-horses the other road is preferable.

From the summit of Mount Olympus, above Brusa, the height of the range gradually decreases towards the north-west, while the surface becomes less rugged. The easier of the two roads to Beyjik, passing through Chekirge, skirts the foot of the hills as far as Missi Keui. There it climbs to the top of the ridge, and, crossing an upland plateau for some three and a half miles to the south, reaches the watershed at a pass known as Akhlat Gedi. The character of the abrupt northern slopes of this ridge is similar throughout. A fringe of cultivation stretches up the mountain-side, but vine and mulberry soon give place to scrub oak and thorn, chestnut and walnut to beech and pine. The top of the range is drained chiefly to the southward. It is a rolling country covered with loose forests of oak and fir, enclosing patches of grass land. The soil is thin, and apt to leave the ridges bare. Immediately to the south of Akhlat Gedi the range is intersected by a deep gorge, known as the Kamchi Dukkan Deressi. It runs south-east, and discloses a fine prospect of the southern slopes of Olympus.

Crossing this gorge, the Beyjik road takes advantage of a narrow rocky defile which pierces its precipitous southern side, and penetrates to the southern slope of the mountains. The western side of the defile is formed by a towering limestone crag, rising perpendicularly from the bottom of the gorge, and from this rock the place probably takes its name, Kapulu Kaya (cliff-gate).

From the Kapulu Kaya pass the mountain ridge extends about three hours to the south before the edge of the Rhyndacus valley is reached. This upland bears the same character as that to the north of the Kapulu Kaya pass. The same park-like vegetation prevails, though the country is more rugged, the ridges higher, and the valleys deeper and more abrupt. As the Rhyndacus valley is approached, villages are found with a few

surrounding acres of tilled soil; but a ragged forest of pine covers all the hilltops. There is a brisk local trade in timber. Heavily laden timber trains are frequently encountered, and numerous saw-mills are driven by the rapid streams, which even in late summer contain a considerable volume of water. There seem to be hardly any traces of antiquity in this district. At Narlinar (one hour and a quarter south of Kapulu Kaya) we copied a solitary inscription, much mutilated.

The southern side of the ridge rises about 500 feet above the Rhyndacus bed, at the log-built village of Yurgek, where the Beyjik road strikes into the river valley. The descent from the pine-crowned ridge to the river is very steep. The underlying rock, judging from the cutting made by the stream, is a loose, crumbling, grey shale. Just below Yurgek the river disappears into a ravine, but for a few miles above the village the valley is of considerable breadth, though perhaps never more than a mile and a half. The alluvial soil is cultivated, and bears the usual crops of corn, maize, and cotton, supporting a considerable population. About 3 miles above Yurgek the valley narrows, but a broad, shallow lateral valley strikes off slightly to the southward, continuing the cultivated land, and separated from the bed of the main stream by a low range of hills. In this valley stands Beyjik. South and south-west of this lies the forest-covered hill country, which stretches right across to the Egriguz Dagh and the valley of the Egriguz Chai.

The only towns of any importance in this part of the Rhyndacus are Beyjik, Harmanjik, and Tavshanli. Of these the first and the last possess many remains of antiquity. Tavshanli alone is of considerable size.

1. *Beyjik.*—Beyjik, the seat of a kaimakan, is distant about ten hours from Brusa. The road has been described above. The town is small, and apparently of recent growth. It lies slightly to the south of the Rhyndacus, and separated from it by a low hill. The population is mainly agricultural. With the exception of a pottery, where large coarse jars are made, there seem to be no manufactures. The modern town presents no further characteristics worth notice.

About a mile west of the modern town, and a little to the south of the road, lies the site of Hadriani. The ruins stand on a gentle hill slope overlooking to the south a small fertile plain. Loose stones and *débris* extend for some distance, amongst which rise massive walls of considerable height, composed of large squared blocks. In the modern town of Beyjik, and in the cemetery adjoining the road, are numerous inscriptions.* The ruins have always served as a quarry, and the remains still left are being carted away as material for the new prison in construction at Beyjik. If the stonemason's depredations are allowed to continue, the remains will soon disappear, and the site, which at present promises to repay excavation, will become entirely barren.

* See Le Bas and Waddington, "Inscriptions," vol. iii. 1053–1066.

The size of the remains attest the considerable importance of Hadriani at some period. But the name does not occur in Byzantine documents, and in all probability the town fell early into decay. Secluded amongst hills and surrounded with thick forests, it lay unnoticed, away from the main current of history.

About a mile and a half west from the site of Hadriani are the remains of a castle situated on a small hill overlooking the Rhyndacus. It appears to be of late construction, and was doubtless built as usual to guard the bridge, whose ruined piers cross the Rhyndacus bed immediately below the castle and a few hundred yards above the modern bridge.

2. *Harmanjik.*—The distance from Beyjik to Harmanjik is about seven hours. For the first three hours the road ascends a valley drained by one of the small southern tributaries of the Rhyndacus. Near the villages the soil is cultivated; elsewhere it is covered with thickets of rhododendron and juniper, and at higher levels with a coarse grass. From an hour above Beyjik the underlying rock is grey granite. At a distance of three hours from Beyjik the road reaches a high ridge, known as the Yenicheri Gedi, and from that descends into a thick pine forest, from which it does not again emerge till within a mile of Harmanjik. Beyond occasional glimpses of Olympus to the north and Meran Dagh to the south, there is little to be seen. Here, as elsewhere, the forests have suffered considerably from extensive fires. Not only is the underwood destroyed, but enormous damage is done to the timber by these outbreaks. In late summer forest fires are visible on the hills in every direction, and no attempt is made to check them.

It seems probable that Kiepert's map places Harmanjik some distance to the north and east of its true position, and that it really lies about due north of Egriguz, and at a much shorter distance away than has been hitherto supposed.

In support of this view, it may be noticed—

1. That Perrot (La Galatie, Route-Map) makes the road from Beyjik to Harmanjik take an almost southerly direction, tending but slightly to the east of south. This is quite wrong according to Kiepert's map, which makes the road take an almost easterly direction, tending but slightly to the south of east. The accuracy of Perrot's survey in regard to the details of the route is confirmed by our own observations, according to which the topographical details shown by Kiepert's map are not correct. The accuracy of Perrot's details affords strong presumption for the correctness of his general direction.

2. Moreover, the authorities at Tavshanli, when told that we had come to their town on our way from Harmanjik to Emed, showed considerable incredulity, and told us that we had come by the "longer way." On the information supplied by Kiepert's map, this seemed inexplicable, as Tavshanli lies but little to the east of a straight line drawn from Harmanjik to Emed. But if Perrot's position for Harmanjik

be adopted, and it be remembered that Emed has to be placed much further north than has hitherto been done, it becomes obvious that our route Harmanjik—Tavshanli—Emed lay along two sides of a triangle whose apex is Tavshanli.

3. The neighbourhood of Harmanjik seems to be wrongly delineated on Kiepert's map. As neither the Rhyndacus nor its valley are visible from the town or the high land in the neighbourhood, it is improbable that they can lie so close to Harmanjik as shown on the map. Secondly, the stream on the north bank of which Harmanjik is situated does not flow into the Rhyndacus a little to the west of the

VALLEY OF SINJAN CHAI.

town. Against this Perrot's survey, confirmed by our observations, is conclusive. This stream flows south away from the Rhyndacus, and is most probably the Harmanjik Su, of which we heard when inquiring the course of the Bodaghan Dere stream. It is a tributary of the Egriguz Chai, and joins the Rhyndacus at Kestelek. On the whole, it would appear that the cartographer has transferred to this Harmanjik the details which belong to another Harmanjik lying to the south-east where the same details recur. But, whatever be the explanation, it is certain that neither the position nor the topography of Harmanjik are satisfactory as shown on Kiepert's map.

The town of Harmanjik calls for no special notice; it is small and unimportant, the seat of a mudir. A large loggiaed building, formerly a barracks, is the most prominent feature of the town. In the neighbourhood is a chrome iron mine.

3. *Tavshanli, Moimul, and the Plain.*—Tavshanli lies about six hours

south-east from Harmanjik, two from Delikli Tash. It is on the section of the Rhyndacus above that hitherto described under the name of the middle Rhyndacus. The town is built on the slopes of low arid hills, which form the eastern limit of an alluvial plain about 4 miles in breadth. The surrounding hills present monotonous similarity. They are treeless, barren, wind-swept masses of dun-coloured rock, for the most part bare, or at best covered with but a thin soil, which supports little vegetation. Their rugged outlines, and the almost complete absence of verdure, bring to mind the Mokattam hills near Cairo. The underlying rock appears to be a light tufa, like that of the famous Delikli Tash. The plain on the edge of which Tavshanli stands is more fertile, and supports several villages. These are surrounded with clumps of trees, and stand out like islands above the dreary level of the plain, which in winter is a swamp.

This barren country which surrounds Tavshanli is entered upon by the Harmanjik Tavshanli road, about two and a half hours to the north-west of Tavshanli. It is the commencement of an entirely new district, geographical and geological, and of a quite distinct civilization. Hitherto the road has traversed a country looking west; it now enters on a region looking south and east. Hitherto the country has been drained by the middle Rhyndacus, the hills have been covered with thick forest; the country on which the road enters at this point is treeless and barren —the district belongs to the valley of the upper Rhyndacus. What traces of ancient civilization there are in the valley of the middle Rhyndacus bear the mark of an Hellenic origin. The upper Rhyndacus district is naturally connected with the Phrygian region to the east, the impress of whose civilization is plainly marked in the antiquities of Tavshanli and the neighbourhood. As compared with the forest-covered hill country west of Tavshanli, the district to the east offers easy and obvious communication. On the frontier of this sphere of Phrygian influence stands the Delikli Tash as a sentry. A rugged and striking mass of yellow tufa rock juts out into a narrow valley. Part of the south-eastern face of this has been artificially shaped to represent a façade surmounted by a pointed gable. At some little height above the sloping ground, and approached by steps, a false doorway is carved, having double doorposts and a moulded lintel.* The neighbouring rocks bear many traces of artificial shaping; one rock is certainly gabled, but there is no trace of a tomb. The tufa is easily cut into chambers. Everywhere it assumes the most fantastic outline in weathering, and the effect is heightened by the colour of the rock, which ranges from grey to a rich golden hue.

Tavshanli itself is a large compactly built town. Though a

* For plans, sketches, and description of Delikli Tash, see Perrot, 'La Galatie,' pp. 104–107; Perrot and Chipiez, 'Art in Phrygia,' pp. 86–94 (English translation).

considerable proportion of the population is Armenian, the town boasts six or seven mosques. The Armenians appear to occupy the greater part of the large bazars, and seem prosperous and contented. Their church is surrounded by a graveyard containing some ancient Armenian tombs. The town faces south-east. Half a mile to the west on the Delikli Tash road lies Moimul looking south-west, from the further slope of the arid hills which here project into the plain. Both of these towns contain inscriptions, but Tavshanli is said to be a Seljuk foundation, and Moimul is reputed to be the old town. In both inscriptions often occur, and most frequently on one type of tombstone—a Naiscus with round arch, panelled door below, and pointed gable above. This form of tombstone with its well-marked door is so universal in these towns that it can hardly fail to suggest a connection with the characteristic door tombs of Phrygia, of which the Delikli Tash is the westernmost example. The numerous tombstones and inscriptions at Tavshanli and Moimul evidently originate from a large site. Beyond their existence, neither town appears to possess any claim to an early foundation, and it is possible that the stones were brought here from Azani.

3. *The Southern Tributaries of the Rhyndacus.*

From Tavshanli several important roads radiate. One leads eastwards to Kutaya, another south-east to Azani, while a third makes for Balat, taking, to begin with, a south-westerly direction. After crossing the Rhyndacus and its plain, and surmounting a low col between Dere Keui and Gyuljuk, this road leaves the main river behind and enters on the basin of its southern tributaries. The valley which it enters after Dere Keui descends from the Bodaghan Dagh on the east in a westerly direction. The Balat road follows it by the side of a small stream, pointed out to us as the Harmanjik Su, which is said to join the Rhyndacus below Harmanjik. The route taken by us, however, clearly proves that this stream cannot join the Rhyndacus between Yurgek and Tavshanli. Still, the name Harmanjik Su may be in a sense correct, as it is extremely probable that the stream from Bodaghan Dagh is a branch of the stream which comes down the Uzun Dere and past Harmanjik. In this case the main stream would come from Harmanjik to a point somewhere north of the Egriguz Dagh, where the Bodaghan Dagh branch would join it. The Balat road appears to follow the Bodaghan Dagh stream round the north shoulder of the Egriguz Dagh past its junction with the Harmanjik Su, and later with the Egriguz Chai, and so westwards to Balat. It has been fully dealt with in Part II. of this paper.

At about two hours' distance from Dere Keui a road diverges in a southerly direction from the Tavshanli-Balat road, and leads to Emed. It passes through the village of Sulya to the south of the Bodaghan Dere, and strikes up a deep rocky valley, running from east to west,

and converging on the Bodaghan Dere a little to the west of Sulya. Down this gorge, which is known as the Jeviz Dere, comes a stream from Küprüjik. After ascending the Jeviz Dere for a couple of miles, the Emed road climbs its southern side on to a lofty ridge, crosses the Essi Bey Dere, a bare rocky valley lying east and west, which falls away rapidly in the direction of Egriguz, and climbs a steep hill beyond, on the south-western side of which lies Emed.

The town is situated in a notch in the hills, surrounded on the north and east by low crumbling cliffs and steep earth slopes. A new barracks in process of construction to the south of the town, points to its being a military centre for the district. The town is compact and populous; on market days it is thronged by peasants from the surrounding district. At the lower end of the town is a group of hot springs. One of them pours a copious stream of water directly into a bath, and its temperature is so great that a plunge is most painful. One of the springs smells of sulphur. In the Turkish cemetery to the east of the town are numerous ancient stones, some columns of dark blue marble quite 2 feet in diameter, and a few naisci, such as we found at Tavshanli. But most of the remains consist of square bases. These are very numerous, but the limestone is so soft that they are much weathered, and the inscriptions very illegible. One votive inscription refers to a cure, doubtless effected at the hot springs. On the west of the town is a recently opened rock-cut grave. An ancient pottery jug which we bought in the town was alleged to have been found in this grave, but is perhaps of far greater antiquity, and indicates a very early settlement on this site. The remains and the hot springs point to the existence of a Greek site at or near Emed, with a church.

Some 8 or 10 miles to the west of Emed lies the Egriguz Dagh, a lofty range of forest-clad mountains running north and south. Its rugged outline forms a landmark for many miles round. The highest point of the ridge lies about due west of Emed, across the valley of the Egriguz Chai. The road from Emed to Simav crosses the southern spur of this range over a high pass about 20 miles south-west of Emed, and from there descends into the wide plain of Simav.

A consideration of the distances on this Tavshanli—Emed—Simav road brings out the fact that Emed and its neighbourhood, with the entire range of the Egriguz Dagh, has been placed *much* too far to the south on Kiepert's map. The distance from Tavshanli to Emed, on our reckoning, must be considerably less than the distance from Emed to Simav, yet Kiepert makes the former distance nearly double the latter. Emed must therefore be moved to the north, as shown in the accompanying map. This is confirmed by plane-table and compass observations taken from three points on the western side of the Egriguz Dagh, from points near Hamza Bey, Sinekler, and Araklar. These observations fix the peak of the Egriguz Dagh, which bears due west

from Emed, and confirm the position of the latter town as determined by the distances on the roads. With the position of Emed, the range of the Egriguz Dagh and the town of Egriguz must also move to the north. The longitudinal position of the district requires no alteration.

The Egriguz Chai, which flows between Emed and the Egriguz Dagh, is a strong, rapid stream. It rises on the northern slopes of the Shabhane Dagh near Gediz, and, flowing in a north-westerly direction, passes by a narrow gap through an intervening ridge of hills into a small alluvial plain, where it is swollen by several brooks descending from the southern spurs of the Egriguz Dagh. On one of these, about

EYRIGENZ.

3 miles from the left bank of the river, stands Assarlar, a small village, but important on account of its ruins and inscriptions. A quarter of a mile below the village a large marble block bearing a long inscription is built into a rude bridge. In it mention is made of the πανήγυρις of Apollo in the grove.* The inscribed block is so massive that it cannot have been brought from any distance. Most probably it came from the neighbouring hillside, where the villagers have excavated a remarkable piece of building. Two massive bits of wall have been uncovered parallel to one another. They are constructed of immense blocks of the local limestone, and do not appear to extend far into the hillside. They most resemble the piers of a triumphal arch, with a projecting

* For the description, see Le Bas and Waddington, 1011; and C.I.G., 3847b.

eave course where the arch would spring. Around these ruins lie several small bases and capitals, and a litter of loose stones. Assarlar is probably the *provenance* of the inscribed marble block at Egriguz relating to the ὁμοβώμιοι θέοι.* There is also at Egriguz a large moulded marble block, now forming the lintel of the doorway leading to the rock castle which overhangs the town. This probably came from the same source as the inscription, a source which is not to be looked for at Emed, where the remains, except in the columns from the church, are all of soft limestone, and show poor workmanship. In all probability, then, Assarlar must be considered as the site of the grove of Apollo, and also of the cult of the ὁμοβώμιοι θέοι, in which case Tiberiopolis can with considerable probability be placed at Assarlar.

To return to the Egriguz Chai. Shortly after passing Assarlar, this stream enters the long straight valley lying between Emed and the Egriguz Dagh. From the right bank of the river the treeless, cultivated slopes rise gradually to the east, culminating in a bare ridge perhaps 1000 feet above. The town of Emed can be seen from the river in a hollow below the ridge, about 600 feet above the river-bed. The western bank is formed by the foot-hills of the Egriguz Dagh. As the river flows north the valley becomes narrower and deeper, its sides more precipitous. At Egriguz a limestone crag, 500 feet in height and crowned with a ruined castle, blocks the valley. Under the eastern end of this crag, and beneath tremendous precipices on the opposite side, the Egriguz Chai has cut a narrow gateway only a few yards broad, known as Demir Kapu. This projecting crag is not more than 200 yards in thickness, and is connected with the hills on the west by a saddle-shaped isthmus, astride of which is the village of Egriguz. The castle is Byzantine, but little is left of it save a strong gateway on the western side, protecting a steep stairway now in ruins. This is the only means of access to the crag, and leads to a shelf which runs right round the rock. Above the shelf (which is about 100 feet higher than the town) rises another crag, a citadel within a citadel, whose western end bears traces of building. A mile or two north of Egriguz the river passes through a second ravine, only inferior to the Demir Kapu in grandeur. Through this wooded hills are visible in the distance, but the course of the river below is concealed from view. It is, however, now certain that it joins the Rhyndacus above Kirmasti, near Kestelek. Flowing north through the second ravine, it is probably joined by the Bodaghan stream, which we last saw skirting the mountain spurs of the Egriguz hills. Below this point it must turn to the west to reach Gune; for four hours south of Gune it is joined by another tributary (to be described below), and is found at Gune flowing in a north-westerly direction. The road from Kutaya *viâ* Tavshanli Balat and

* Le Bas and Waddington, 1021; and Ramsay, 'Hist. Geogr.,' p. 147.

Balukiser to the Dardanelles probably followed the course of the Bodaghan stream to its junction with the Egriguz Chai, and then struck westwards up one of the tributaries which join the Egriguz Chai from the neighbourhood of Balat.

One other stream remains to be noticed, which drains the western slopes of the Egriguz Dagh and joins the Egriguz Chai four hours above Gune. It takes its rise in a depression in the hills immediately north of Lake Simav, and only a mile or two distant from it, at a small hamlet known as Hamza Bey. Only a slight rise divides the watershed from the basin of the lake. From Hamza Bey the stream flows due north to a point below Sinekler. At first the valley is featureless and uninteresting, with scrub-covered slopes of whitish earth. As it dives into the heart of the hill country it becomes deep and rugged, and its sides often rocky. Below Sinekler the stream passes through a fine gorge between castle-like rocks. The surrounding hills are either bare or else covered with thick forest. Villages are numerous, commonly built of large pine logs, but they are poor and mean. At Sinekler the road leaves the river valley and turns north-west to Balat. Somewhere in the maze of rugged hills north of Sinekler, the stream joins the Egriguz Chai at a point which can only be conjecturally fixed by its reputed distance from Gune. Only one feature of its valley demands special attention. In the valley between Sinekler and Tash Keui, and immediately beneath the latter, are the remains of an important temple site. In a field on the right bank of the stream are traces of building and many large squared stones. There are only two inscriptions visible. One records a dedication to Zeus Pandemos, who is probably the Zeus of Abrettene, a Mysian god mentioned by Strabo in his story of the robber priest Cleon.* Cleon's stronghold Callydium is not known, but might be found anywhere in the neighbourhood of Tash Keui. This rough track of country would afford a most secure home for a strong robber band.

Between Tash Keui and Balat the Dikeli Tash forms a prominent landmark. It is a natural pinnacle of tufa rock about 30 feet in height, standing on a hillock of the same stone to the south of the road. There are numerous traces of cuttings in the surrounding rocks. In one place steps are cut; in another there are marks possibly indicating a rock tomb, but some natives armed with picks and wedges, while engaged in quarrying hard by, produced exactly similar marks, so that it would be rash to assume that any of them are ancient. Still, the rock is such as Phrygian tomb-cutters loved, and the stone, from its singular shape and prominent position, must always have been venerated.

From the rugged hills round Balat several streams descend through rocky glens eastwards to the Egriguz Chai. The streams themselves are of little size or interest, but the town of Balat must detain us for a few moments. The town is large. It is said to contain six thousand

* Strabo, § 574.

houses, and is well watered and clean. With the exception of a small colony of Greeks (twenty houses in all, and a church dedicated to Hag. Demetrios), the population is Mohammedan. Overhanging the town is a singular hill of naked grey granite with jagged upright strata; its slopes are strewn with massive rugged boulders. To the east of Balat, between the town and the Egriguz Chai, there is much tufa rock.

There must have been a city at or near Balat in antiquity, but no identification is possible at present. From an inscription referring to "the Senate and People of the Hadrianeans," which we found at Balat, it will appear that this town, if not actually in the territory of Hadriani, was in close connection with it. It is hardly probable that the inscription has been brought to Balat from Hadriani, a distance of some 30 miles over rough country, as there are numerous other remains round Balat itself.*

Above Gune, then, the Egriguz Chai has received the waters of the Bodaghan Dere and the Harmanjik Su on the east, and on the west the streams from Hamza Bey and those from near Balat. At a point near Gune it plunges into a succession of ravines and narrow deep valleys, keeping a little to the west of north till, after passing the ridge of the Sinjan Dagh on its left bank, it takes a sudden bend to the west near the Kasik Bel, and then flows in a north-westerly direction to join the Rhyndacus a couple of miles below Kestelek. From Gune to the Rhyndacus valley the country on both sides consists of rugged hills entirely covered with thick forests of oak and pine. The roads are difficult for travelling on horseback, and impassable for wheeled vehicles. The only feature of interest between Gune and Kestelek is a group of colonies of Rumelian refugees, who are engaged in reducing to cultivation part of the forest south of Kestelek. From Kestelek a road leads in a south-westerly direction across the Egriguz Chai, and then over a high range of wooded hills to the Macestus valley at Kebsud. The basin of the latter river is entered at Delanderos Bel, nearly four hours north-east of Kebsud. There are no antiquities on the route; in fact, nothing interesting beyond the extraordinary medley of races that inhabit this ridge—Circassians, Turkmans, Yuruks, and Rumelians, in addition to numerous Osmanli villages.

The main valley of the middle Rhyndacus and the basin of its southern tributaries, that is to say, the country from Olympus on the north to the Egriguz Dagh on the south, and from Delikli Tash on the east to the Macestus watershed on the west, possesses few sites, and plays a very unimportant part in history. In the Mithridatic wars this region was held with Abbaitis and Phrygia Epictetus for the Romans by C. Salvius Naso.† The Byzantine wars raged round the hill district. It

* See Le Bas and Waddington, vol. iii. pp. 1044–1052.
† C.I.L., xiv. 2218.

is a country too broken alike for military operations, commerce, and agriculture. Rapid and easy communication can never have been possible across it, but both the road through Balat and the road up the Macestus seem to have been occasionally traversed, even by armies, as has been shown in the preceding section of this paper.

TABLE OF ALTITUDES. BRUSA TO KIRKAGACH.

Place.	Feet above sea.	Number of readings.
Narlinar (camp below)	1467	2
Beyje	1468	4
Yenicheri Gedi	2952	1
Harmanjik (camp below)	2019	2
Spring near Yeni Keui	2917	1
Tavshanli	2662	2
Emirler Keui	2748	3
Jeviz dere	2903	1
Emed	2506	1
Yenijik (camp above)	3223	3
Simav	2733	2
Saüjilar	2502	4
Assar Keui	2281	1
Sinekler	1949	2
Balat	1947	2
Guno	1405	2
Ashar Balik Keui	1787	2
Sej Keui	2036	1
Bigadich	416	3
Chobanlar	1209	2
Kirkagach	484	1

Postscript.

Since these pages were printed, I have paid a flying visit to Balia, and passed within a few hours' ride of Khydyrlar. It was too hasty an excursion to solve all the problems raised in the second part of this paper, but certain facts may be noted which seem to bear upon them.

There was an ancient town at or near Balia Maden. Its name, as given in an inscription recently found there,* was Perichaxis. The name seems to connote a settlement which had grown up round an entrenched camp.† The conjunction of the names Balia and Perichaxis shows the prophetic insight of Mr. Ramsay's remark: ‡ "Three of the places named Palia appear to have been fortresses, and hence the set of names in *Teichos* and *Charax* suggest themselves for comparison." The *charax* at Balia was probably succeeded by the castle, the ruins of which crown the nose of rock at the junction of the two

* Published in the *Harmonia* of Smyrna, February 22, 1895, quoted in the *Bull. de Corr. hell.*, xviii. p. 541, and *Mitth. aus Athen.*, xx. p. 236, and more correctly from a squeeze by Kalinka in *Mitth. aus Oesterr.*, xviii. p. 228 (but the space before ὁ δῆμος is really blank).

† Compare Arrian's description of Phasis, 'Periplus,' 9, and the Roman *canabæ*.

‡ 'Hist. Geogr.,' p. 163.

valleys an hour to the north of the town. This position must have had a certain importance (there are remnants of two Roman bridges in the eastern valley), but scarcely enough for Pœmanenum. Moreover, the last section of the direct road from Balukiser to Balia is too rough for wheels. The carriage-road runs farther south, and turns northwards after rounding the castle of Gumenij, or Dömenidj, as Kiepert has it. This castle was described to us as much stronger and more imposing than that at Balia. It lies half a dozen miles to the south of the town. These facts about the ancient name, the roads, and the castles, seem to show that Pœmanenum is to be sought, if my argument is correct, not precisely at Balia, but perhaps at Gumenij.

The conjecture that Artemea may have been at Khydyrlar is to some extent confirmed by what was told us in the neighbourhood of ancient remains there. We were too hard pressed for time to visit the site, but I hope to return some day and settle the point.

J. A. R. M.

GEOGRAPHICAL WORK OF THE GEOLOGICAL SURVEY OF CANADA, 1896.

By Dr. GEORGE M. DAWSON, C.M.G., F.R.S.

THE exploration of geographically new territory by this Survey during 1896 has been less considerable than in many previous years, various circumstances having tended to confine the work more strictly to the detailed examination of comparatively limited tracts. Of exploratory work, however, in which considerable additions to geography have resulted concurrently with geological reconnaissances, Mr. A. P. Low's traverse of the northern part of the Labrador peninsula, Dr. R. Bell's survey in the basin of the Nottaway river, and Mr. J. B. Tyrrell's examination of the country to the north of Lake Winnipeg, may be referred to.

Mr. Low reached Hudson's bay by descending the Moose river from Missinabi station, north of Lake Superior, on the Canadian Pacific railway. From Moose Factory, he coasted the east shore of the bay for about 500 miles to Richmond gulf, the initial point of the new work to be undertaken. Starting from Richmond gulf, a portage-route was followed 75 miles to Clearwater lake, which was found to be about 45 miles long and 20 miles across in the widest part. From its north-east corner a route 10 miles long was followed to Seal lake, which is more than 60 miles long, but from 1 to 5 miles wide only. The water-shed passes close to the eastern end of this lake, and was crossed at an elevation of 900 feet above sea-level. A small lake immediately beyond the watershed discharges into the Stillwater branch of the Koksoak river, which was descended 275 miles to its mouth. The first 65 miles is very rapid and shallow, after which it is easily navigable with canoes.

The country passed through is semi-barren, with small spruce and larch trees growing only in the valleys, the hills being either bare or covered with arctic shrubs. Laurentian gneisses and granites preponderate everywhere, but the Cambrian rocks with iron ores were again met with, forming a wide belt. The ice of the Glacial period flowed, as shown by the rock-striation, both eastward and westward from the vicinity of the watershed, the ice-parting lying, apparently, a short distance to the east of the present height of land. Mr. Low returned from Ungava bay by steamer round the east or Atlantic coast of Labrador.

Dr. R. Bell's explanatory work was in continuation of that accomplished by him in 1895, in the basin of the Nottaway or Noddaway river, one of the largest streams falling into James bay. Some thirteen branches of the main stream were surveyed for parts of their lengths. A canoe-route from Waswanipi lake northward to the Rupert river was also mapped, crossing the valley of a considerable stream, which empties into James bay south of the Rupert, and is sometimes known as the Broad-back river. Several large lakes occur on this route. Dr. R. W. Brock, Dr. Bell's assistant, made a long track-survey up the Waswanipi river to the eastward, eventually reaching Mistassini lake. When the work accomplished has been laid down, it will form a substantial addition to the map, and will enable the distribution of the Huronian and Laurentian rocks, between which the country here appears to be divided, to be represented with considerable accuracy.

Mr. Tyrrell spent the summer exploring the country north of Lake Winnipeg and the lower portion of the Saskachewan river east of Nelson river, and north of Burntwood and Churchill rivers. No exploration of this country has been made since the days of the early fur-traders, when David Thompson made track surveys of the canoe-routes there. Pine, Wolf, Grass, and part of Burntwood rivers were surveyed, and some additions were made to our knowledge of the geography of the Nelson river, and the lakes into which it expands.

The country was found to be a rather low-lying plain, sloping gradually north-eastward from an elevation of 1250 feet to 550 feet above the sea. The southern portion of the area is fairly level plain underlain by flat-lying Palæozoic limestone, which on its northern side breaks off in an abrupt escarpment from 50 to 100 feet in height; and thence northward the surface is gently undulating, and is underlain by Archæan rocks. Throughout a large portion of the district these rocks are buried under a covering of stratified clay, a deposit of the glacial lake Agassiz, which will furnish rich agricultural and grazing land, and may be of considerable importance in the event of a railway being built from Manitoba to the west coast of Hudson bay.

The progress of the geological mapping of Canada is, unfortunately, retarded very greatly by the want of the necessary geographical and

topographical surveys, which in older countries are placed in the hands of the geologist when he enters the field. There is scarcely any part of the Dominion in which much of the time and energy of the geologist, or of an assistant who may accompany him, must not be spent on the actual measurement and delineation of the country in which he may be at work. Thus it happens that practically every map issued by the Geological Survey constitutes at the same time the best available geographical map of the district covered by it, and includes numerous features never before represented. This is the case even in the older provinces, and, although it would be tedious to follow in detail the various surveys made in many different parts of Canada during the year, it may be stated that these have in all cases added very materially to the geographical features.

ON THE FORMATION OF SAND-DUNES.*

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Sect. I.—Scope of the Investigation.

The distribution of pebble, sand, and earthy dust by wind and by water is in present operation over a large part of the Earth's surface, comprising the coast dune-tracts, beaches, the beds of rivers, of lakes, about one-fifth part of the floor of the ocean,† the deserts, and the moister districts bordering on them, where is fixed the dust which is continually fanned away from the deserts in which it is manufactured. The author is engaged upon an investigation of phenomena attending the making and distributing of pebble, sand, and dust. The present paper upon the formation of Sand-dunes contains the first instalment of results.

Under the action of a wind of any given strength, pebble, sand, and dust may be differentiated thus: pebble is rolled, but not lifted; dust, when raised, hangs as a cloud; sand may be lifted, but settles quickly. Stuff of which the grains run larger than shot is not usually called sand, but it is difficult to fix a limit of size which shall differentiate sand from pebble, because any increase in the force of wind is accompanied by an increase in the size of grain which the wind can lift. Now, one of the most remarkable phenomena attending the distribution of earthy materials by wind (or water) is the *sorting* action exercised by the fluid. The formation of sand-dunes, as I shall show, is accompanied by and largely depends upon this sorting process; and in the present paper I shall call any earthy material which undergoes sorting by wind, "sand." It is evident that a material cannot be sorted unless it is heterogeneous. It is, of course, conceivable that the sorting might be completed; but the definition will have served its purpose if it holds until the necessity arises for considering such a case.

In this matter of sorting there is a difference between the dunes of deserts and those of sea-coasts, the latter being formed of a material from which the dust has been pretty completely sifted out by the action of water. The building up of coast dunes raises the general level of the land, but wind-action lowers the general level in deserts; for the bulk of the blown sand is less than that of the denuded

* Paper read at the Royal Geographical Society, January 19, 1897.

† See *Challenger* Reports, "Deep-sea Deposits."

rock by the amount of the dust which settles outside the desert, as chaff settles beyond the threshing-floor.

The plan of work adopted in the present research has been to deal first with the behaviour of blown sand upon a *manageable scale*, and then to apply the results to the elucidation of the larger phenomena, which is the method of the experimental sciences. Further, I have kept the phenomena of water-waves constantly in view, and as the research has progressed, I have been confirmed in the opinion that sand-dunes are best studied in conjunction with waves. There is no real danger of pushing the analogies too far, for the small-scale observations enable one to deal with sand in a *molecular* manner, which effectually guards against such mistakes as would arise from treating the material as a mere fluid.

Sect. II.—The Rippling of Sand by Wind.

1. *Conditions of Rippling.*—When a wind of suitable strength blows upon loose sand, a mottled appearance is quickly produced, which is the commencement of ripple-mark. I found on the sands at Branksome, in Dorset (between Bournemouth and Poole), that, when the rippling had become sufficiently regular to admit of measurement, the wave-length, or distance from crest to crest, was 1 inch, the average diameter of the sand-grains being $\frac{1}{2\cdot5}$ inch. The following measurements of the sand-ripples made by wind were taken at different times and in various places between Branksome and Poole Haven. The measurements are given in inches.

Number of observation.	Wave-length.	Mean diameter of sand-grains.	Height of ridge (amplitude).	Number of grains in height.	Length. / Height.
I.	1	$\frac{1}{2\cdot5}$	—	—	—
II.	$1\frac{1}{4}$	$\frac{1}{3\cdot6}$	—	—	—
III.	$1\frac{1}{2}$	$\frac{1}{8\cdot5}$	$\frac{1}{16}$	5 (calculated)	20
IV.	$1\frac{1}{2}$	$\frac{1}{60}$	—	5 (counted)	18
V.	$1\frac{3}{4}$	$\frac{1}{70}$	$\frac{1}{16}$	8 „	17
VI.	$2\frac{1}{4}$	$\frac{1}{65}$	$\frac{1}{8}$	8 (calculated)	17
VII.	$2\frac{1}{2}$	$\frac{1}{34}$	$\frac{1}{8}$	7 „	20
VIII.*	$3\frac{1}{4}$	$\frac{1}{45}$	$\frac{1}{8}$	—	26
IX.	$3\frac{1}{2}$	$\frac{1}{46}$	—	8 (counted)	$18\frac{1}{2}$
X.	$4\frac{1}{4}$	$\frac{1}{29}$	$\frac{1}{4}$	—	17
XI.	6	$\frac{1}{45}$	$\frac{5}{16}$	16 „	18
XII.†	7	—	$\frac{1}{2}$	20 „	14

From observations III. to XII., I conclude that *amplitude and wave-length increased in the same proportion.* By combining I. and II. with III. to XII., I deduce that *regular rippling was observed with an amplitude of three grains from trough to crest.*

The uniformity of the wind-ripple pattern is at all times remarkable. In water-formed sand-ripples no such uniformity has been recorded except when there has been some agency, besides the resistance of the sand-grains of the ridges, to throw the water into waves.‡ In the case of wind-formed ripples, on the other

* Noted at the time as "hasty observation."

† Smaller ripples were forming on the weather slope.

‡ See G. H. Darwin on "Ripple Mark" (*Proceedings Royal Society*, 1883-4), and a paper on "Ripple Mark" by the present writer (British Association, Liverpool Meeting, Sect. C (Geology)).

hand, I concluded, from the fact that the wave-length increased steadily with the time during which the wind blew, that the sand-grains were the source of those regular undulations of the air the existence of which is attested by the uniformity of the ripple pattern. This conclusion I was able to verify by the artificial reproduction of the ripples by means of the steady blast employed in sand-blast work. The experiments were carried out at the London Sand-blast Works, Gray's Inn Road, W.C., where a room, with the requisite machinery, and the services of a workman, were kindly placed at my disposal by the proprietor. Sand, both sorted and unsorted, was of course to be had in abundance. The blast was first turned upon a quantity of sand taken from a box which served as receptacle for the sand swept from the floor of the room. In a few minutes the surface became rippled, and the ripples grew in height, in wave-length, and in regularity, under the constant blast.

I then tried a coarse assorted sand from which all fine stuff had been carefully sifted.* In this no rippling was produced even after long-continued blowing, either with a gentle blast or with a wind so powerful that the grains rattled as they rolled and jumped along. On mixing the coarse (assorted) with a finer (assorted) sand, rippling was, however, quickly produced. The finest variety of the assorted sands (which was found to contain a considerable number of grains of larger size) was also quickly rippled.

These experiments, and others which confirmed them, illustrate in a very striking manner how heterogeneity controls the tactics of sand. Taken in conjunction with the observations of natural ripples, they enable me to state the following

LAW OF RIPPLING BY WIND.

The rippling of sand takes place when the eddy in the lee of the larger grains is of sufficient strength to lift the smaller.

The statement connotes that if the wind be too strong for the larger grains to stick and make an eddy, there is no rippling—all is as dust before the wind. If, on the other hand, the eddy be too weak to lift the smallest grains, the material behaves as a bed of stones or pebbles.

2. *The Profile of Ripples.*—The profile of all the ripples measured in the sand at Branksome is approximately a triangle having a windward angle of 4°, and as the leeward angle the maximum resting slope of the sand (see Fig. 1).

FIG. 1.—PROFILE OF WIND-FORMED RIPPLES—FIRST APPROXIMATION.

In order to represent the form more exactly—a matter important in its bearing upon dunes—the windward slope must be drawn, not as a straight line, but a curve having an inflection near the middle. Below this the curve is hollow-backed, above it is round-backed—a shape very like that of the weather slope of the wind-forced waves of water. The stream-lines of air which give this shape to wind-ripples in sand may be inferred from Fig. 2, which is Prof. G. H. Darwin's representation of the stream-lines when a current of water is made to flow over existing water-formed ripple-mark. As a witness to the great activity of the eddy in the apparently sheltered troughs of wind-formed ripples, I may call attention to the curiously scoured look of the surface of the sand under the steep lee slope. The surface is often finely striated in the direction of the wind by the action of

* By artificial means; we are now dealing with a manufactured product.

the lower part of the eddy, which action is in the same line as that of the wind, although opposite in sense.

The long flattened vortex, or eddy, hollows the lower part of the windward slope, while the descending portion of the superincumbent (air) billow rounds

FIG. 2.—WATER-FORMED RIPPLE MARK UNDER CURRENT ACTION, SHOWING STREAM-LINES.

off the upper part of the slope. Finally, the lee slope of the wind-formed ripple is not necessarily all straight line (as shown in Fig. 1), but may terminate in a curve. Thus the normal profile left by the rippling of sand by wind has the following parts: viz. a windward slope, consisting of a concave and convex curve; and a lee slope, consisting of a straight line and a concave curve (see Fig. 3).

FIG. 3.—PROFILE OF WIND-FORMED RIPPLES, SECOND APPROXIMATION.

The straight line is due to the incoherence of sand, which causes it to slip, and thus prevents it from taking the cusped form which is reached in wind-forced water-waves, owing to their quick travel.

In a sudden violent squall at sea, when the motion of the wave is slow relatively to the motion of the wind, it is hardly possible for a cusp to form, the tops of the billows being cut off and drifted away as a white spray. Similarly, I have not observed any cusp in the slow-moving sand-ripples even during the continuance of the wind, when the grains on the lee side have the support of the eddy.

A curve at the bottom of the lee slope can be produced (in deep sand) by the excavation of the eddy, but under other conditions, particularly on the large scale in dunes, the gentler slope at the bottom of the lee face may be a talus derived, first, by the coarsest grains rolling from the summit beyond the foot of the steep slope; and, second, by a *sediment* composed of so much of the finer sand caught by the eddy as has not been again tossed away. Some of this sediment may also be found upon the steeper part of the lee face.

I have now to deal with the profile of a *group* of ripples, and to explain the mechanism which maintains constant the ratio of amplitude to wave-length in a group. The backward motion of the eddy arrests the forward motion of the larger grains rolled up the weather slope, and thus co-operates with the direct current of wind in raising the crest. The vertical motion of the eddy gouges out the finer grains from the trough; raises them to the crest; whence, in co-operation with the wind which blows over the ridge, it sends them flying to leeward, along with the finer parts of the sand which drifts up the weather slope. Thus the amplitude of the ridge is increased by simultaneous excavation and elevation. Whether the increase of amplitude of the ridges is accompanied by a raising or a lowering of the general level of the sand depends upon the quantity of sand which is supplied from more exposed situations, and upon the strength of the wind. At the moment of failure of each gust of wind, the pattern is smoothed or even blurred; the recurrence of the gust restores the sharpness to the pattern. With a thick sand shower, however, it may happen that no rippling occurs, for the

surface may be renewed so quickly that wind has no time to make ripples. Similarly, where the surface of water is constantly renewed (from below) the water has a smooth, oily look, because wind has no time to ruffle it. If the supply of sand diminish, the eddy, after a time, cuts down to the bottom of the loose sand; a number of *isolated ridges are left, resting upon a hard bed; and in these, if the sand shower fail, the wind will force the windward to as steep a pitch as the leeward slope* (Fig. 4).

FIG. 4.—PROFILE OF A GROUP OF WIND-FORMED RIPPLES ISOLATED UPON A HARD BED.

The ridges of wind-formed ripples advance almost entirely by the rolling of the larger grains of the top layer over the crest. The motion is slow, for the eddy opposes the wind; one foot per hour would be pretty good travelling. The rate of advance of a ridge diminishes with increase of amplitude, for the advance is by rolling of the top layer, and the number of layers of sand-grains is proportional to the amplitude. A growing ridge consequently lags, thus increasing its distance from the next leeward ridge. Again, the increase of height of the windward ridge is accompanied by increase of strength of the eddy and by increase of length of the air-billow which tops the eddy, so that the sand shower is thrown further to leeward. This is a part of the mechanism by which the ratio of amplitude to wave-length is kept constant. The remaining part of the mechanism is the quicker travel of lower windward ridges, which results in their catching up and becoming merged in the ridges to leeward, as will be described in the next sub-section.

During the whole process of rippling by wind, the sand is being winnowed, the smallest grains being transported furthest, so that when the wind has blown for some hours, one may see, at the weather end of a group of ripples, isolated ridges of coarse sand upon a hard bed (of which the windward may be as steep as the leeward slope). Further to leeward the troughs are not cut down to the hard bottom, but here the sand is much coarser in the upper than in the lower layers of the ridges, showing that the finer sand has been carried away from the surface. Still further to leeward the rippling has a beautifully smooth look, the sand being much finer than the ordinary sand of the locality.

3. *The Ground Plan of Ripples.*—In order that ripples, the ridges of which are transverse to the wind, may be produced, the sand must contain an abundance of grains which offer sufficient resistance to produce an eddy. Groups of these give the mottled appearance* which precedes the formation of regular ridges. These patches extend themselves transversely by a mechanism similar to that which increases the height of the ridges (the eddy opposing the direct current, and thus arresting the motion of the larger grains). The process must be imaged as taking place in plan instead of in profile. The original patches thus quickly unite at their ends in transverse chains. The lateral dimension of the ridges increases much more quickly than the wave-length; I have known ridges increase from 2 inches to 20 feet laterally, whilst the simultaneous growth of wave-length was from 1 inch to 3 inches. This was on a bed of loose sand, where the eddy can excavate in shelter. The quicker travel of the lower ridges (which was alluded to in the last sub-section) is a part of the mechanism by which the ripple pattern acquires its

* Compare the reticulated pattern produced at the moment when a gust strikes the surface of water before the waves have had time to spread, and the little balls of fleecy cloud, like puffs of smoke, which sometimes form so quickly over the sky, and presently coalesce in parallel bars.

surprising uniformity, the lower ridges becoming merged in the larger, the younger in the older. Fig. 5, drawn from observation on the beach of Hale, in Cornwall, illustrates this curious process. Along CE, ridges 2 and 3 have already joined. On the line AB, 2 has a small amplitude, as shown in the section, and will soon

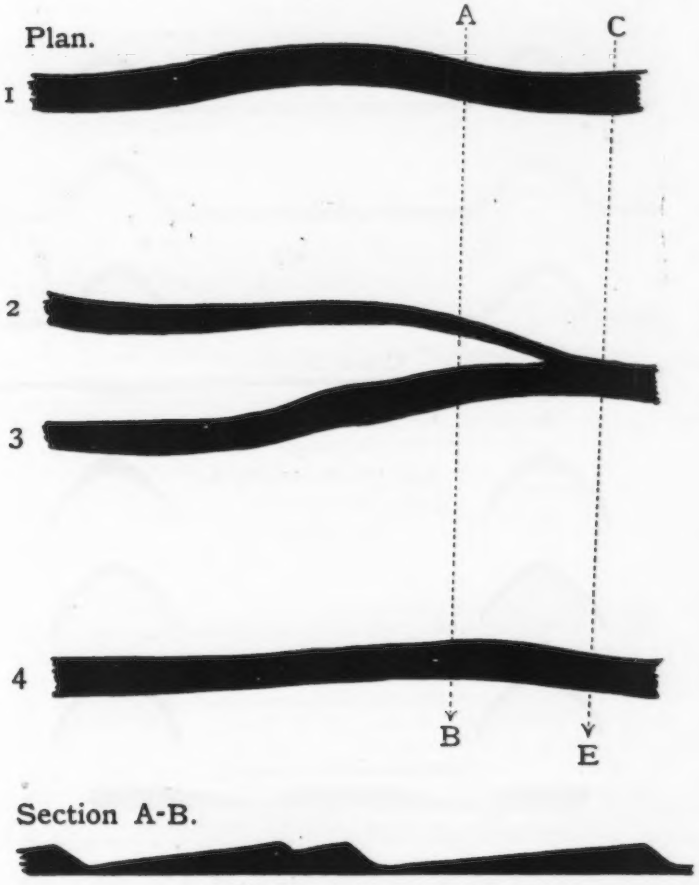

FIG. 5.—THE COALESCENCE OF RIPPLES.

catch up 3. The broad black bands in the plan indicate the short leeward slopes of the ripples; the intervening spaces are the long windward slopes.

Beyond the edges of a patch of loose sand the lateral growth of the ridges proceeds with difficulty, for on a hard bed the eddy cannot excavate, and the wind has more driving power. The ends of the ripple ridges at the edges of the patch of loose sand are curved forwards, so as to be concave on the lee side. I have seen rippling in coarse sand on a hard bed (the pathways by the roadside at Torquay)

in which the short, curved, broad ridges had the shape of a five-days'-old moon. The importance of this cusped form will appear later on.

It remains to describe some phenomena of rippling which are interesting for the light they throw upon the origin of longitudinal dunes, and of the longitudinal rows of horseshoe depressions which are known as fuljes in Arabia. I observed

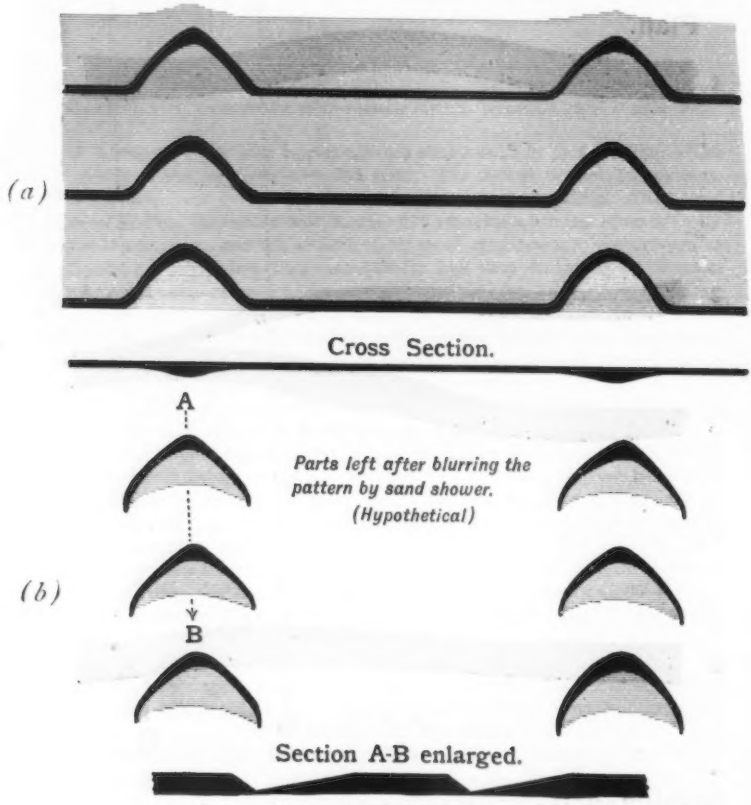

FIG. 6.—RIPPLE STRUCTURE HOMOLOGOUS WITH "FULJES."

the phenomena referred to in the mobile shell sand of Hale, in Cornwall. A brisk wind had been blowing for some hours over a large, deep, and nearly level bed of the dry shell sand, which was covered with a very regular rippling of about 3 inches wave-length. Standing with face to wind, I noticed that at slightly irregular intervals, of about 12 inches on an average, parallel rows of markings occurred, which could be followed for a long way from ridge to ridge, the direction of the rows of markings being at right angles to the ridges—that is to say, parallel to the wind. Closer examination showed that each of these markings was a blunt arrow-headed inflection in the ripple ridge, the arrow-heads pointing up wind (Fig. 6, *a*). In the arrow-heads the troughs were deeper than in the straight portions,

but I did not notice that the crests were higher. At the apex of the arrow-head the trough was, I think, deepest. I particularly noticed that the sand-grains at the arrow-heads were much coarser than on the straight parts of the ridges. This shows clearly that along the lines of the arrow-heads the wind had greater power than elsewhere. The eddy, as well as the wind on the crest, was consequently stronger, and, as compared with the other parts of the ridge, excavation had the advantage as compared with elevation. Along the lines of the arrow-heads, the ratio of amplitude to wave-length was greater than in other parts of the bed of sand.

The arrow-heads pointed up wind, showing that the ampler portions of the ridge had lagged during the march of the ridges. This is the general rule, but it may seem strange that it should hold in a case where the greater amplitude is due simply to exposure to a stronger wind. It must be remembered, however, that in a stronger wind many grains are whirled from the crest which in a gentler wind would roll down the lee slope, and thus contribute to the advance of the ridge.

Now, suppose that the sand shower increases so that all but the deeply cut parts of the pattern are smoothed over. The pattern left would be that shown in Fig. 6, *b*, which gives (1) the form of the fuljes, (2) the mode of their arrangement, (3) the manner of their occurrence as holes in a bed of deep sand (see § IV.). It is also important to note that if the sand shower failed, the wind remaining as before, channels would be cut in the sand along the lines of the arrow-heads.

I shall now pass on to the study of dunes, which is closely allied to that of rippling, but in which some new factors are introduced. The first of these is the *time factor*. Ripples are so small that, practically, their form is always that impressed by the wind which is actually blowing; or, if we observe them in a calm, by the wind which last blew. A permanent dune is so large that the wind never holds sufficiently long to obliterate the effects of former winds. Thus *size alone may make a dune a permanent hill even if it be composed of loose sand throughout.* Given a constant climate, a large desert dune might conceivably outlast the highest mountains, for the denuding agent renews the surface. On the other hand, there is a necessary limitation of the process by which dunes grow, which prevents their attaining heights equal to those of mountains formed by erosion. The winds have greater power at considerable elevation than near the surface of the ground, so that, even if a group of sand-hills of excessive height were piled up artificially, more sand would be removed from the summits than the wind would bring, and this lowering of the summits would not be compensated by the deepening of the troughs, the work of the wind at the summits being assisted, and that in the troughs being hindered, by gravity. The result would be to form an elevated desert of deep sand surmounted by dunes of moderate height. In the case of a group of mountains formed by the cutting of valleys, the limiting height of mountain above valley is not so readily attained, for the "head" of water increases with the depth of valley, and gravity does not act in opposition. The forms of dunes, and of groups of dunes, have a greater variety than those of ripples, and are often more complicated, for a dune may register the impress of many changing winds.

Another important difference between the small-scale and large-scale phenomena is that in the latter *the heterogeneity of wind* is much more important. In this term I include both intermittence and the want of uniformity of the cross-section of a sheet of wind. Unlike wind-ripples, dunes do not necessarily owe their origin to the resistance of the sand-grains. In the case of transverse dunes in deep deserts there appears, however, to be actual continuity between ripple and dune, the latter being (on this supposition) old ripples. Rippling action plays a part in the shaping of every dune.

Sect. III.—The Vertical Section of Dunes.

There is a great variety of shapes proper to dunes. Instead of dealing with the different shapes *seriatim*, I prefer to consider all varieties together, first in section, and then in plan. The grouping of dunes has also to be considered, which I do by dealing with the profile of the groups in the present section, and with their ground plan in Sect. IV.

The profile of dunes corresponds to what is generally called the form of a wave, viz. the section in the direction of the wave's motion. The cross-section, which is less characteristic, will be dealt with more shortly.

The lee slope of dunes is the angle of rest of the sand, and therefore varies slightly. The practice of making the vertical scale greater than the horizontal should not, I think, be followed in representing dunes. The windward slope may be of any steepness up to the natural limit of the angle of rest. *In dunes formed by a dominant wind in deep sand*, the windward slope varies somewhat with the density of the sand shower (tending to decrease the angle) and with the power of the wind (tending to increase the angle), but in no case is the slope a steep one. The profile is comparable to that of wind-formed ripples; the amount of sedimentation upon the lee face of dunes is, however, greater than in ripples.

On a hard bed the windward slope may be forced by the wind to the angle of rest when the sand shower fails, and in this case the dunes are widely separated. On the other hand, wind blowing outwards from a deep sand tract forms a *horizontal* plateau terminated by a talus as steep as the sand can rest. Under these conditions the encroachment of sand recalls the manner of advance of a glacier, and to this formation I restrict the term "sand glacier."

Reversible wind can produce dunes having both the front and the back steep, without failure of the sand shower, even in a deep sand deposit. The form differs from that of dunes produced in deep sand by a dominant wind, in much the same way that the forms assumed by two sets of sea waves when meeting fairly and crossing differ from the form of an ordinary sea wave running before the wind.* The formal analogy is very close, although the "short sea" which is said to last for a time after the wind has suddenly flown round is perhaps a better physical analogue. The first effect of reversal of wind, as Dr. Sven Hedin has pointed out, is to turn the top of the dune (Fig. 7), and the occurrence of such a double slope is

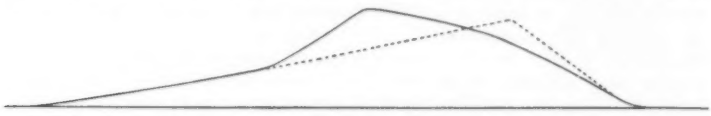

Fig. 7.—The first effect of reversed wind, turning the top of the dune.

sure evidence of changed wind. The more frequent the reversal of wind and the larger the dune, the more nearly do the conditions correspond to the oscillation by which the knife-edged sand-ripples of the sea are formed. In a deep sand tract *where dunes are growing in reversible wind*, groups are formed in which the greatest ratio of amplitude to wave-length occurs. It was pointed out in Sect. II., (2), that when a windward ridge increases in amplitude it lags, travelling more slowly than a lower leeward ridge, the distance between them therefore increasing. By such adjustments the smaller ratio of amplitude to wave-length is speedily restored in ripples, but on the large scale in dunes the adjustment requires much

* See Dr. Sven Hedin in the *Geographical Journal*, October, 1896.

time, and is frequently incomplete when the wind drops. Suppose this wind to have been from the west, and let the wind next blow from the east. The eastern ridge at first approaches nearer to the western, for, being of smaller amplitude, it moves faster. Its motion may be retarded by increase of amplitude, and when its amplitude is equal to that of the western ridge it will no longer diminish the distance between them. The increase of amplitude has, however, further increased the ratio of amplitude to wave-length. A group of dunes in which this ratio is as great as possible, I call a group of "shortest dunes." If the angle of rest of the sand be $33\frac{1}{2}°$, then the narrowest sand-hill is three times as broad as it is high, and if such hills be placed side by side (Fig. 8), the distance from crest to crest is three times

FIG. 8.—THE SHORTEST AND CLOSEST (ARTIFICIAL) SAND-HILLS.

the height, or amplitude. Thus a limit is imposed by gravity upon the shortness of a dune and upon the closeness of a group of dunes. The above figure gives the profile of such shortest sand-hills as might be piled up with a spade; the shortest and closest *dunes* (sand-hills formed by wind) would be better represented by Fig. 9. In speaking of the amplitude instead of the height of dunes, one avoids a common source of confusion, due to the fact that the vertical distance from trough to crest may increase by the lowering of the trough as well as by the raising of the crest. It is only in the case of dunes isolated on a hard bed that "the height of a

FIG. 9.—THE SHORTEST AND CLOSEST DUNES (SUBJECT TO REVERSIBLE WIND).

dune" can be spoken of without ambiguity. The deepening of the troughs during strong wind, which has been mentioned in connection with my small-scale observations, has been observed on the large scale by M. G. Grandjean.* In the centre of a dune tract exposed to reversible wind, the tops of the dunes attain the greatest elevation above the surrounding country. In a section of the coast dunes of Gascony given by M. Grandjean in the paper just referred to, the amplitude is greatest where the maximum elevation is attained. In broad dune tracts, such as are met with, for instance, in Arabia, the greatest amplitude would not necessarily coincide with the greatest elevation, for the amplitude of the dunes does not depend only upon the supply of sand, but upon a sufficient force of wind. A heavy sand shower in a failing wind increases the general elevation of the deposit of blown sand, but diminishes the amplitude of the dunes; much in the same way that a quiet fall of snow raises the level, while smoothing the contour, of a country. The statement that the growth of *dunes* is proportional to the difference between the

* "Les landes et les dunes de Gascogne," *Bull. Soc. Geogr. Coml. de Bordeaux*, March, 1896.

amount of sand brought and the amount removed by wind, only applies, therefore, to dunes isolated upon a hard bed, for the greatest difference is when no sand is removed, under which condition, in a deep desert, the dunes would be obliterated, an elevated sandy plain being formed.

Where dunes are diminishing in reversible wind, they have, again, a symmetrical form, but the tendency is to leave a smoothly rounded surface such as indicates the failure of the *tossing* action of the eddy. The surface of a country covered with such dunes would have the form of a rolling prairie (Fig. 10). I deduce two sets

FIG. 10.—DEGRADED FORM OF DUNES SUBJECT TO REVERSIBLE WIND.

of conditions for producing such a surface, viz. (1) "leeward" position in a desert where sand which has been sifted from all the coarser grains deposits in light winds; and (2) exposed parts of a desert where mounds of pebble* are left (perhaps from steeper dunes of which they are the relic) when all the finer sorts of sand have been winnowed away. These forms recall the ground-swell of the ocean. The sharp crest of a dune is where the sorting action goes on; when, as in the above cases, there is very little sorting action there is no longer a sharp crest. In like manner the ground-swell owes its smoothly rounded billows to the absence of that wind-eddy which supports the lee slope of a storm-wave, and assists in sending from its sharp crest an intermittent shower of spray.

With regard to the *cross*-section of dunes (a term, by the way, which has no significance where winds blow from all quarters), the sides or flanks of *growing* dunes appear to be gently sloping curves. Steep straight sides sloping at the angle of rest indicate depletion by scouring (Fig. 11).

FIG. 11.—CROSS-SECTION OF DUNES WITH FLANKS SCOURED BY WIND.

A steep, straight slope, where the sand has slipped owing to the scour of wind, may easily be mistaken for the leeward face of a dune. Where the depletion has proceeded until the two scoured sides meet at the crest, giving a knife-edge, the form may be mistaken for the production of reversible wind. From this moment the continuance of a scouring wind will preserve the shape, but diminish the height and breadth of the dune. Thus modes of degradation as well as modes of growth must be taken into account in studying the forms of dunes.

Sect. IV.—The Ground Plan of Dunes.

The study of the ground plan of dunes corresponds to that of wave patterns—a neglected part of the science of waves. Dunes are waves produced in sand by wind, and two factors determine the wave pattern, viz. the rippling action and the current action. Rippling tends to produce (transverse) bars, current tends to produce (longitudinal) stripes, and the wave pattern is a compromise between the two. Similarly, in a gentle stream the front of the wave made by a stone or pebble has the form of a blunt arrow-head pointing up stream; in a

* Compare Fig. 19, "Kieswüste," in Prof. J. Walther's 'Die Denudation in der Wüste,' which shows the gently rolling surface of a pebbly desert.

torrent the swift current lengthens the arrow-head almost to a stripe, the limiting case being the striping of a waterfall or of the crest of a breaker. The transverse growth of a dune is the spreading of a wave; the drift of the sand to leeward is the flow of a stream. I shall show that the tactics of sand are such that the two velocities—the wave-spreading and the wave-making * which accompanies the drifting of the sand—do not vary the one as the other, and that this is why the greatest

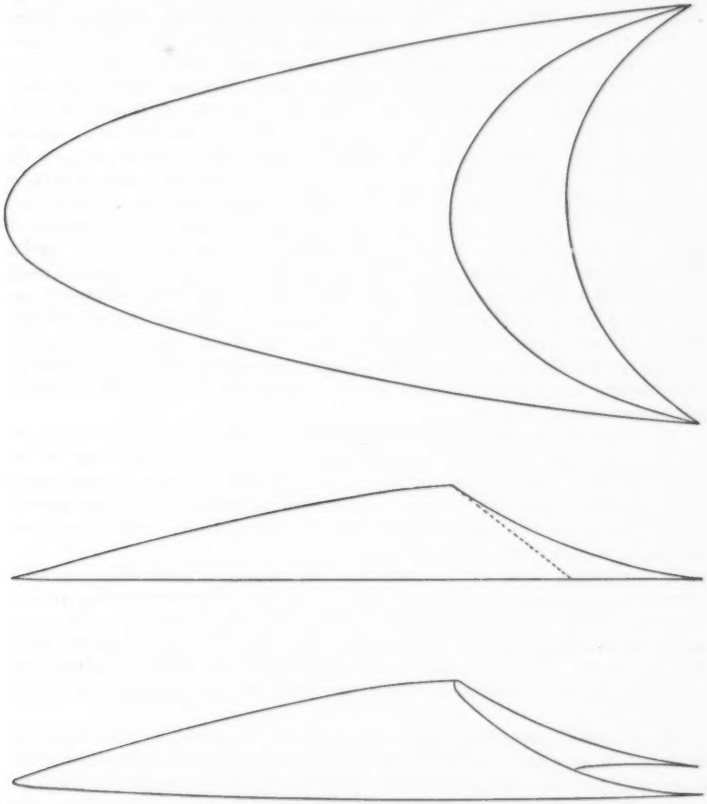

FIG. 12.—BARCHANE OF THE SAHARA.
(*Adapted from G. Rolland.*)

extension of a dune may be either transverse or longitudinal, *i.e.* at right angles to, or in the direction of, the wind.

When a moderate wind blows upon deep sand, the conditions are favourable to the production of ridges of great transverse extension, for the eddy burrows along sideways in shelter, and the forward current, flowing over the loose sand, has

* Expressed more generally thus—the rate at which a disturbance is created, and the rate at which it spreads.

very little driving power. At the edges of the bed of loose sand lateral growth proceeds with greater difficulty, for the lower layers of air derive additional driving power from the spring imparted by the hard elastic bed. Thus the sand-grains drift more freely, and even if the motion of the sand be arrested so as to form an eddy, the work of the eddy is handicapped by the circumstance that it cannot excavate.

The dunes called *barchanes* usually have their greatest extension in a longitudinal direction (Fig. 12). This form occurs in the Sahara,* in Central Asia,† in Peru ‡ (where they are called *medanos*), and probably in other localities also. They form here and there upon the desert floor where the wind will let them. It appears that they neither occur in localities where the sheet of wind has everywhere the complete mastery over the sand, nor where the burden of the flying sand is everywhere too great for the carrying power of the wind; they dot the desert plain in localities where the sheet of wind has, for the most part, the mastery of the sand, but drops its burden here and there at certain points, or more probably along certain *stripes*. A rapid current of air can no more flow smoothly and with uniform strength over the ground than a rapid current of water can flow uniformly upon a rough channel or between winding banks. Wherever there are opposing lateral deflections, there is a double burden of sand, with a current relatively, perhaps absolutely, feebler, and here the sand drops. The lateral growth of the nucleus thus formed is slow, for the reasons already explained, but its longitudinal increase may be rapid, for the rapid current of air may carry past the edges of the dune great quantities of sand which, meeting with laterally opposing motions on the lee side (see Sect. V.), are there dropped and become part of the dune.

The *horns* or *cusps* of the barchanes, pointing to leeward, are readily explained, for the lowest parts of the dune travel quickest. A form as of the moon in her first quarter (*i.e.* with the cusps pointing in the direction of motion) is the form of front proper to a travelling sand-wave—as viewed in plan. In this case gravity does not operate, so that the incoherence of sand does not hinder the formation of the cusp as it does in the profile of dunes.

It has already been shown that, when the supply of sand fails, the wind increases the steepness of the weather face of a dune. The corresponding alteration in the ground plan of a barchane is the shortening of the body of the dune and an increased development of the horns (Fig. 13). The case is similar to the widening of the angle of the track of a steamer when the speed of the vessel is decreasing, the waves maintaining their speed, but the wave-creation proceeding more slowly.

Fig. 14 shows a permanent, practically stationary, conical dune, such as would be formed from a barchane which had been exposed to winds from all quarters under conditions favourable to growth. The sun's rays have probably assisted to preserve the conical form. Heated air commonly rises in spiral whirls, evidence of which, in our own climate, is afforded by the shape and distribution of the cumulus clouds which form in the sky on a summer morning. It is easy to see that a conical dune, under the rays of the sun, will be the centre of a whirl of ascending air, which will catch the flying sand and help to build up the cone.

A barchane exposed to a dominant wind under conditions favourable to growth, would become a permanent and practically stationary longitudinal dune, such as

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* See Rolland, *Bull. Soc. Geol. de France*, 3me ser. ix. and x., 1880–81.

† See Bellew, *Geographical Journal*, xlvii.

‡ See Bollaert, *Geographical Journal*, xxx., 1851.

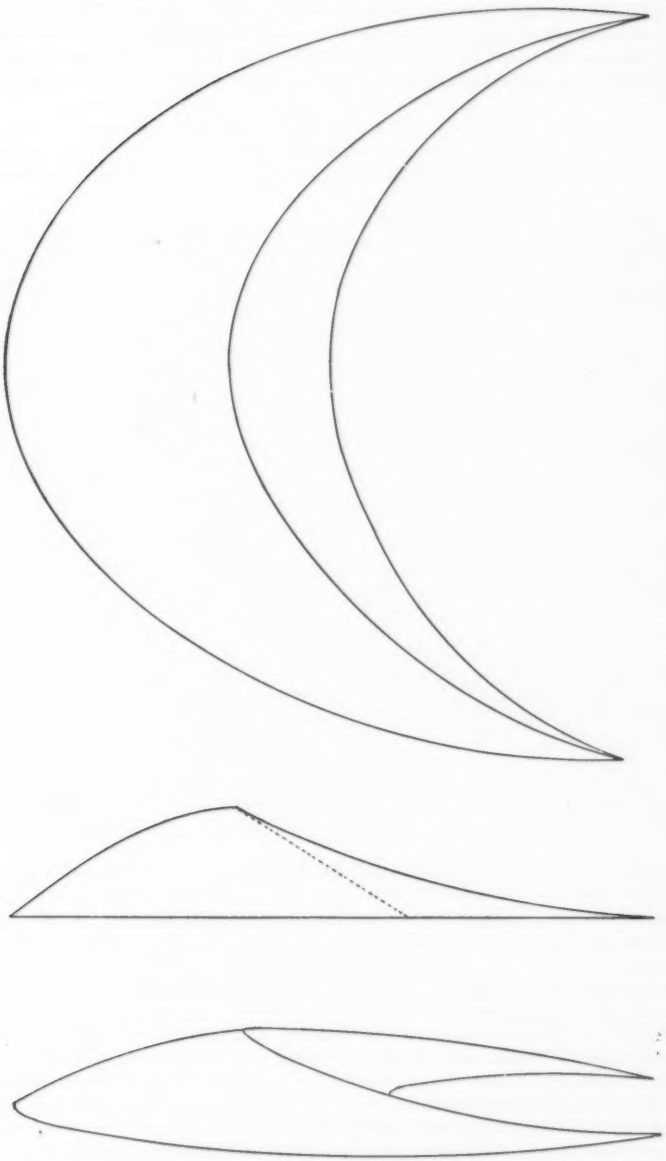

FIG. 13.—BARCHANE, AFTER EXPOSURE TO WIND IN A FAILING SAND SHOWER.

is found in Sindh. The Great Indian Desert, having been carefully mapped, affords an unusual opportunity for the convenient examination of the plan of dunes over a large area. The winds of the district are the south-west and north-east monsoons, the former of which is the stronger; and the supply of sand comes from the south

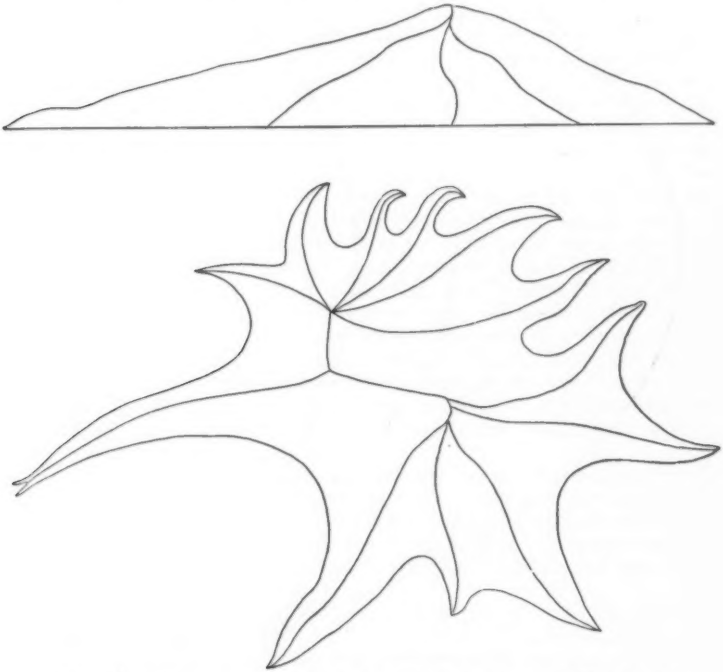

FIG. 14.—STATIONARY CONICAL DUNE OF THE SAHARA, HEIGHT 52 METRES.
(*After Schirmer.*)

and west. Near the Rann of Cutch the dunes are longitudinal (Fig. 15), further inland they are transverse (Fig. 16), and between the districts shown in these figures an intermediate form is shown upon the maps (Fig. 17). In this desert the shower of sand appears to fail as the wind fails, and, instead of a deep deposit of blown sand in the inland districts (such as there is in the Nefûd of Arabia), there are isolated transverse dunes. The appearance of the longitudinal dunes upon the map recalls that of the *stripes* of sand which are laid down upon a sandy beach at each lull of the breeze upon a windy day. Mr. Blandford, in his admirable description * of the dunes of the Indian Desert, clearly states that the longitudinal type is associated with a greater force of wind. He also states that the steep slope on the north-east or lee end shows that no theory of accumulation under the lee of bushes will account for the facts (see also Sect. V.). This conclusion is strengthened by the *distribution* of the dunes, which, although not uniform, is systematic. The

* 'Geology of India,' 2nd edit. p. 455, *et seq.*

circumstances of this distribution come out clearly when one examines sheet after sheet of the survey maps of this great dune district. The longitudinal dunes are largest and are widest apart where the wind blows most strongly, and get nearer together as we proceed from south and west to north and east. Then a district is reached where the longitudinal ridges are laid down so closely that they are frequently united in a transverse ridge; and, finally, the longitudinal striping is reduced (as Mr. Blandford has pointed out) to a subordinate feature of the windward slope of transverse dunes. Thus the longitudinal striping is in direct relation

FIG. 15.—LONGITUDINAL DUNES OF THE INDIAN DESERT. (SCALE 1 INCH = 2 MILES.)

with the force of the wind and with the burden of sand which it bears. I am not aware that there is any evidence to show that there is, or has been, *a similar distribution of extraneous obstacles.*

The dunes mapped in Fig. 15 have both flanks steep, which I take to indicate that they have spread laterally during lighter winds, but are scoured during stronger winds. Now that the country is thickly covered with these long high ridges, the force of the wind must be considerably increased in the narrow longitudinal valleys.

The transverse dunes of the inland districts of the Indian Desert appear to be produced by the laying down of stripes side by side where the force of the winds is sufficient to induce rippling, and not so great as to mask its effect by excessive drifting at the edges of the patch of sand.

The lateral development which often appears to characterize the dunes of sea-

coasts probably originates the prevalent idea that a dune *ought* to be a transverse ridge. I wish to point out that, *the source of the sand-supply of coast dunes being itself a long strip transverse to the dominant wind*, the whole group has of necessity an exaggerated lateral extension; and, where the sand-supply is copious relatively

FIG. 16.—TRANSVERSE DUNES OF THE INDIAN DESERT. (SCALE 1 INCH = 2 MILES.)

to the force of the wind, individual longitudinal coast dunes tend to merge in one another, forming a ridge of which the greatest extension may be transverse. Where the wind has more mastery over the sand, coast dunes clearly show the longitudinal development.

The longitudinal ridge and the transverse ridge are the completed forms of dunes due to a wind whose direction does not change, one or other form being taken

according to circumstances, the most important of which is the strength of the wind.

Where the winds blow from all quarters these primary forms are no longer evident, and the ground plan of the dunes may be of every shape. Such a dune tract may be comparable to the curiously corrugated surface of open sea exposed to variable winds (which is carved into furrows and ridges, basins and mamelons, pits and pyramids) ; or it may resemble the troubled surface of the water in rapids of a stream, in which waves are created at a great rate, but spread slowly. To any case the principles already explained may be applied. In addition, it is sometimes necessary to take into account the shifting of the position of the source of sand, particularly on coasts where the sea has receded, and on the sand-spits which grow at the mouths of rivers.

Under the present heading, "Ground Plan of Dunes," I must discuss fully those curious hollows in blown sand, called fuljes in Arabia, to which allusion was made in Sect. II., (3).

Mr. W. S. Blunt considered that the prevailing wind in the district of the

FIG. 17.—DUNES OF THE INDIAN DESERT INTERMEDIATE BETWEEN THE LONGITUDINAL AND TRANSVERSE TYPES.

Nefûd of Arabia which he visited was easterly. The eastern portion of the tract, he says, "is but a series of long strips, from half a mile to 5 miles in breadth, separated by intervening strips of solid plain," but on the north "the transition from the bare gravel plain of the Hamád is very startling. Its edge is so well defined that it is hardly an exaggeration to say that with one foot a man may stand upon the Hamád and with the other on the Nefûd ; nor is there much irregularity of outline. The limit of the sand for several hundred miles runs almost evenly from east to west, and it is only at these extremities that it becomes broken and irregular." The following sentences have been italicized from Mr. Blunt's description * of the fuljes : "The most remarkable phenomenon of the Nefûd are the *long lines* of horsehoof-shaped hollows, called fuljes (Fig. 18, *a*), with which its surface is *pitted*. These are only observable where the sand has obtained a depth of 80 to 100 feet, and are consequently seldom found in the intermittent portion of the Nefûd, while it is remarkable that *in the very centre of all, where it might be*

* See Appendix to the 'Pilgrimage to Nejed.'

supposed the sand was deepest, the fuljes are less deep than towards the northern and southern edges, while the lines in which they run become more regular. . . . *The fuljes themselves are singularly uniform in shape*, though varying in size. They represent very closely horse tracks on an enormous scale—that is to say, *a half-circle deep at the curved end or toe, and shelving* up to *the level of the plain* at the *square end* or heel. The sides of the former are *as precipitous as it is in the nature of sand to be*, and they terminate abruptly where they meet the floor of the fulj. I noticed that just west of the fuljes there is generally a high mound of sand, which adds considerably to their apparent depth. The deepest of those I measured proved to be 280 feet, including the sand-hill, which may have been 50 feet above *the general level of the plain;* its width seemed about one-quarter of a mile. . . . At

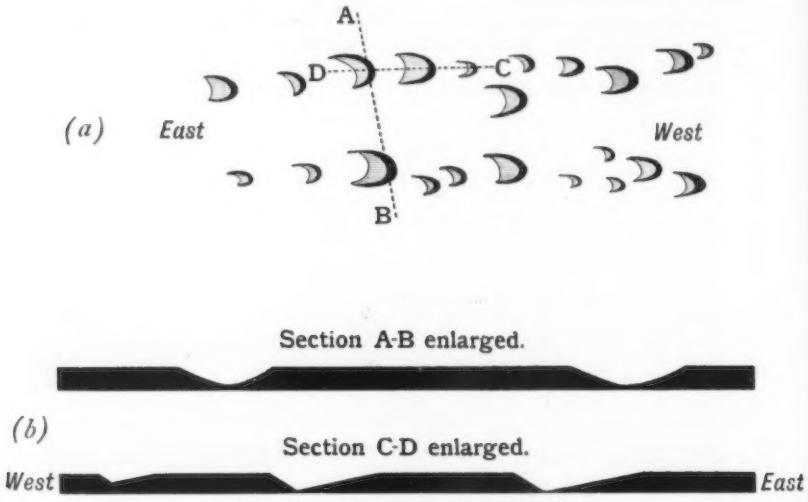

FIG. 18.—FULJES OF THE ARABIAN NEFÛD.
(*Adapted from W. S. Blunt.*)

the bottom of *these deep fuljes solid ground is reached*, and there is generally a stony deposit there such as I have often noticed in sandy places where water has stood. This bare space is seldom more than a few paces in diameter. I heard of, but did not see, one which contained a well. The fuljes, I have said, run in strings irregularly from east to west, corresponding in this with their individual direction." Omitting for the present to take account of the small dune near the curved end, the longitudinal section of a fulj may be represented as in Fig. 18, *b*; that is to say, there are two slopes corresponding to those familiar in dunes—one gentle as that up which sand drifts; and one steep, as that down which the (larger) sand-grains roll.

Drainage, even if adequate to keep such large holes constantly emptied, would not produce these characteristic "windward and leeward" slopes.

In the Nefûd the sand has accumulated faster than the wind could remove it, and under these circumstances a *pit* in the underlying rock, being a place of shelter, would have a greater depth of sand than the surrounding country.

Dr. Euting endeavours to avoid the difficulty of explaining *a sand-pit having*

the characteristic slopes of a dune by regarding only the sand-mass *between* the pits. When the fuljes are contiguous, the intervening sand-masses have the form of dunes (Fig. 19), and the suggestion of Dr. Euting is therefore a contribution

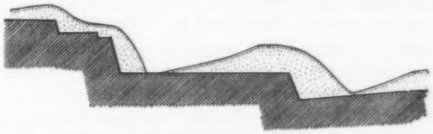

FIG. 19.—DR. EUTING'S HYPOTHETICAL PROFILE OF CONTIGUOUS FULJES.
(*From Prof. J. Walther's 'Die Denudation in der Wüste.'*)

towards the solution of the problem. The supposed kernel of rock shown in Dr. Euting's figure is, however, superfluous, for his row of dunes is such as is normally produced by wind. When, as seems to be usually the case, the fuljes are *not* contiguous, the intervening sand-masses have not the form of dunes, and we cannot, therefore, escape by Dr. Euting's device from the necessity of explaining the shape of the ***pits***.

It is conceivable that pits of this form could be dug out by downward swirls of wind, the steep slope being then on the lee side of the pit. A swirling stream flowing over a sandy bottom digs such holes, but I have never seen wind dig holes in blown sand after this fashion.

I have, however, observed and described (see Sect. II., (3)) a mode of action of wind whereby horseshoe spaces are kept wholly or partially clear of sand during a sand shower. If my description of this phenomenon be compared with Mr. Blunt's description of the fuljes, it will be seen that the action which I observed accounts (1) for the occurrence of pits in a deep desert, (2) for pits having the very characteristic profile of the fulj, (3) for their cross-section, (4) for their ground plan, (5) for the arrangement of the pits in rows parallel to the direction of the wind, (6) for the fact that the depth of the holes is not proportional to the depth of the sand deposit, (7) for the fact that the fuljes are seldom found in the sand of the intermittent Nefûd (the strips of hard ground between the sand-ridges being the positions where such rows of pits would have been, but that the wind has there had too complete a mastery over the sand).

It will be observed that the process of formation of fuljes is allied to that of the laying down of a dune tract in longitudinal ridge and furrow. The fact of such a connection was recognized previously to my observations. Mr. Blunt says, "Mr. Blandford suggests that the fuljes are spaces unfilled with sand, and if this be so the strings of fuljes may in reality mark the site of such bare strips as one finds in the intermittent Nefûds."

FIG. 20.—SMALL DUNES AT THE STEEP END OF THE FULJES.
(*Adapted from W. S. Blunt.*)

In one point there is a discrepancy between Mr. Blunt's narrative and my detailed explanation. He makes the east wind dominant, whereas my explanation requires a dominant west wind. Here, however, Mr. Blunt's small dunes at the edge of fuljes come to our assistance (Fig. 20). These are evidently formed by a dominant

east wind, but from the top of the dune to the bottom of the fulj is *a double slope indicating changed wind*. When Mr. Blunt visited the Nefûd the east wind had evidently been operating for some time, but it is easy to see that its work is exactly opposite to what is recorded in the form of the fulj.

There remains the problem, How have the fuljes been *kept open*—as many of them evidently have—through a long period of time? With regard to the keeping open of the corresponding channels in the intermittent Nefûd, the solution is obvious, viz. that the driving power of the wind is increased in the longitudinal valley, so that the distribution of wind-power which originally formed the channels is constantly reproduced so as to keep them open.

In the case of a string of fuljes, however, there appears to be no adequate cause to ensure the permanence of that particular distribution of wind power which produced them. After this admission I anticipate some such criticism as the following: "You have stated that pits in the underlying rock, being places of shelter, would, in the Nefûd, be filled in deeply with sand: are not the fuljes equally places of shelter; and if there is no means to secure the permanence of the original distribution of wind, will not the sand deposit thickly in the fuljes, quickly obliterating their characteristic section and gradually filling them up?" The reply to this criticism is as follows: The two cases are radically different, because *the fulj can move*; the wind can scour away sand from one side while it rolls in sand from the other, and excavate the bottom while it showers in sand at the top. Thus the conditions of permanence of a fulj are almost exactly the conditions of permanence of a dune composed of loose sand throughout (see Sect. II., (3)). Fuljes may fill up slowly in the Nefûd, but it would be almost as unlikely for a very large fulj to disappear as for a very large dune to be destroyed; and, even if the size diminish, the fulj will retain its characteristic shape.

[For an account of *square* fuljes, see the discussion at end of this paper.]

Sect. V.—The Action of Obstacles.

In the following statement of those tactics of sand which are special to the neighbourhood of obstacles, I rely largely upon observations and experiments with obstacles of *a manageable size* carried out partly by the sea-shore and partly with artificial blast.

Obstacles influence the distribution of sand by wind in two ways: directly, as mere obstructions, and indirectly, by affecting the motions of the air. The weather side of a WALL obstructs flying and rolling sand, but the effect of a wall upon the distribution of blown sand is not confined to this mechanical obstruction, for the wind evokes an eddy on each side (Fig. 21). Now, the eddy on the weather side

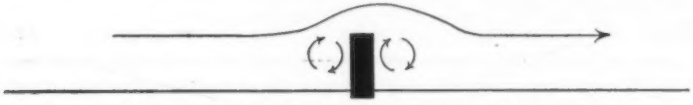

FIG. 21.—EFFECT OF A WALL UPON THE COURSE OF THE WIND.

tosses the finer grains, and the eddy on the lee side catches some of these and only tosses away the finest of them. Sand therefore deposits against both sides of the wall. If the sand be of a fine sort, and the wind be strong, the principal deposit is on the lee side; if the sand be coarse, the principal deposit is on the weather side. If the wall be of very great height, nothing will at first get over except dust *wafted* in the air. In time, however, the mechanical obstruction offered by the wall results in the building up of a sloping platform on the weather side. When

this platform reaches sufficiently near to the top of the wall, the winnowing action above described commences. The deposit on the lee side, being formed by sedimentation, has not the steep slope which characterizes the lee side of a dune. If, however, by favouring conditions, the sloping platform on the windward side should

FIG. 22.—ENCROACHING SAND, EGYPT. DATE PALMS BEING SMOTHERED.

in time grow to surmount the wall, so that the large grains could roll over, a proper dune profile might be produced.

The end of a wall has a similar distribution of eddies, but with their axes vertical, and the deflection of the air horizontal. The end of the wall is kept

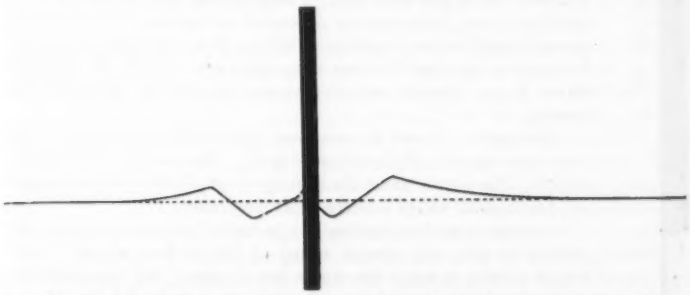

FIG. 23.—EFFECT OF GOUGING AND TOSSING ACTION OF EDDIES NEAR A HARD ELASTIC OBSTACLE (AN APPROXIMATE REPRESENTATION—IN PROFILE).

clear of sand by the scour of the wind. Suppose the wall to be telescoped so that the two ends are close together, forming a *post*. To leeward of a narrow post the opposing eddies are now brought close together; they gather in sand from opposite sides, and, their motions in a horizontal plane being equal and opposite, and the post

being high, the drift of the rolling and flying sand is stopped,* and behind the post is deposited a ridge of sand which tapers and slopes to leeward. A deposit is also formed on the weather side, the coarsest flying sand bursting through the eddy. If the post be supported as a *rail*, the same action of eddies takes place, and the flying sand is brought down in a steeply falling quiet shower. A close combination of posts and rails makes *wattling*, which offers less obstruction than a wall, but, by bringing the eddies into contact, prevents that effective co-operation in winnowing action which helps to keep sand flying past a wall. The action of posts is that of tree-trunks, stems of reeds, and blades of grass, and the action of wattling mimics that of tangled bushes and leafy boughs (Fig. 22).

Sand-shower in a failing wind may completely cover any projection and fill up hollows, just as happens in a quiet fall of snow, the contour of the mantle of snow being smoother than that of the country which it covers. Sand-shower, however, usually comes like *driving* snow, and then an enormous quantity of flying sand must be brought before a hard elastic obstacle can be completely buried. This is due to the gouging and tossing action of the eddies, which clears away all but the coarsest grains in the manner indicated by Fig. 23. The gouging action appears to be stronger on the weather side, where the pressure of the air is greater. The same figure illustrates—*the formation of stationary dunes at a little distance from hills or other obstacles*, and also the practicability of erecting permanent landmarks in the desert. It would also appear to indicate that ancient pyramids, monoliths, colossi, etc., in a desert plain should always be partly covered, but seldom buried in sand. The following passage from Dr. Sven Hedin's recent paper on the Takla-Makan desert bears upon these tactics. He says, "The formation of the mounds near the stem of the *tograk* is very changeable. Sometimes the mounds seem to leave the *tograk* alone and to go round it, and sometimes the tree is wholly embedded in sand, only the branches being visible." Dr. Sven Hedin goes on to say, "I suppose that this is due to the fact that the *tograk*, being entirely dependent on the water in the ground, grows in small hollows invisible to the eye where the water is nearest." It seems to me that the two cases are explained by the different effects of an obstacle according as the wind or the sand has the mastery.

FIG. 24.—DEPOSIT OF BLOWN SAND IN A TRANSVERSE VALLEY.
(*After G. Rolland.*)

The tactics of sand in transverse valleys may be deduced from what has been said of the action of walls. The case is illustrated by Fig. 24. The way in which the drifting power of the wind is increased in a longitudinal valley scarcely needs illustration.

In saucer-shaped depressions it is probable that winnowing proceeds actively at first, the upward spring of the air from a hard elastic bottom tending to keep the saucer free of sand. As soon, however, as the gradual accumulation of the coarser grains has provided a soft bed, the process of filling up should proceed more rapidly.

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* The motion of the sand is not the same as the motion of the air in these eddies, even in the horizontal plane, owing to inertia. The mode of operation of posts or rails may be called *cheating* the wind.

A cliff facing the wind deflects the current of air, which rises in a billow above the edge of the cliff. Below the billow is an eddy, which assists in bringing down sand borne by the wind. Thus a cliff may be capped with blown sand, which deposits in a position apparently exposed, but in reality well sheltered.

In order to appreciate the effects of obstacles in checking the encroachments of blown sand, it is necessary to discriminate between the *travel* of dunes and the leeward *spreading* of a dune tract.

The velocity of a dune is the rate of advance of the crest of the ridge, which takes place by accumulation of sand upon the steep lee slope. The supply is brought in two ways, viz. by the rolling of coarse sand-grains over the crest,

FIG. 25.—UPPER PART MOVING DUNE; LOWER PART FIXED DUNE (EGYPT).

and by the deposit of such part of the flying sand caught by the eddy as is not tossed away again. The permanent part of the accumulation on the lee face is the coarse sand which rolls over the crest, for the finer sand brought back by the eddy is fanned away, when, by the rolling motion of the dune, it is once more brought to the weather side. If the strength of the wind be doubled, and the amount of sand drifted up to the crest be also doubled, it does *not* follow that the velocity of the dune will be doubled, for several sizes of sand which before would have rolled down the lee slope will now be whirled away from the smoking crest. Only in the case of an old dune containing scarcely any fine sand, and upon which a wind bearing but little sand blows, must the velocity be nearly proportional to the strength of the wind. Otherwise the increase of wind may increase the rate at which new dunes are made to leeward, rather than the rate of travel of an individual dune. In this matter considerable difference must be expected between those desert dunes, in which much grinding and pulverizing is going on, and coast dunes, in which the wind deals with a prepared material.

The stage which has been reached in the winnowing and grinding process, as it greatly influences the manner of encroachment of blown sand, so is it of importance in determining the kinds of obstacle which will in any particular case best

resist such encroachment. An old travelling dune, consisting almost entirely of fairly coarse sand, is effectually stopped by the running water of even a narrow stream. On the other hand, it is by the rolling motion of such dunes that prominent obstacles are most readily submerged, emerging, however, as the dune rolls on.

It follows, from what has been stated above, that the most *general* means of checking the encroachments of blown sand is to promote the *growth* of dunes. Binding the surface stops the rolling of the dune, but does not prevent the travel of fresh supplies of sand and the accompanying formation of new dunes to the leeward. On the other hand, *wattle fencing and posts* * (or faggots) may be employed, so as to check the rolling sand, and bring down the flying sand in a thick, quiet shower. This not only hinders the formation of new dunes to leeward, but also builds up a great dune which is practically stationary. Any device for checking the encroachment of blown sand should be capable of adjustment to change of level. This advantage is possessed by posts, which can easily be raised when they have been nearly buried; but *vegetation* has the following advantages, to mention only those which are of a mechanical nature, over artificial appliances. First, vegetation adjusts itself to a rising level; second, a spreading root binds the surface, while stem, branches, and foliage arrest the flying sand; third, the old roots help to consolidate the dune (Fig. 25).

The reclamation of tracts of blown sand is a practical art destined to be of immense importance. For the development of the art, a knowledge of sand tactics is essential, but not in itself sufficient. Other factors come into play which cannot be dealt with in the present paper.

I desire to acknowledge the kind help which I have received in the library and the map-room of the Royal Geographical Society. Especially my thanks are due to Dr. H. R. Mill for the supply of references, and for much valuable criticism. The two plates are from photographs sent me from Egypt by my friend, Mr. E. A. Floyer, F.G.S.

After the reading of the paper, the following discussion took place:—

Prof. Bonney: I should like some one to be called upon to speak first who really knows more about the matter than I do, for my chances have not led me into regions of extensive sand. I have no knowledge, and therefore cannot venture to criticize this very elaborate and, it seems to me, admirable paper. I will only say one word, because I am quite sure that we rather overlook the importance of the wind as a geological agent, though in denudation I do not suppose it often produces very important effects. There are certain special circumstances where, no doubt, as in some great deserts, it is effective in gradually breaking up the surface, and particularly in bombarding it with the grains of sand, but instances of that are common enough in text-books. As a transporting agent it must be extremely important; and then we come to the question whether, in examining ancient rocks, we can identify this wind action, and that certainly seems to be true, because the rounding of a grain of quartz (which is the common material of which sand is composed) in a river takes an immense time. According to Daubrée's experiments, a grain of sand would have to travel 3000 miles before being effectually rounded; so in the ordinary river-bed you will find few rounded grains. You will find them on the seashore, but even there they are not so very numerous. If, then, you find you get a very great predominance of well-rolled grains, you may expect they were manufactured under wind conditions. Now, we do get rocks made up of

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* See Lieut.-Colonel F. Bailey's "Forest Tour among the Dunes of Gascony," *Transactions of the Scottish Arboricultural Society*, vol. xi. pt. iii. 1887.

extremely well-rolled grains. The oldest I have come across were in Charnwood Forest rocks, a little older than the Cambrian period. There, in a bed of slaty rock, we get thin streaks of sandstone which are almost entirely made up of perfectly well-rolled grains. This region must have been like a desert, where the wind had considerable action on broken-up sandstone, and brought in sand among the ordinary fine sediment. Then, again, I find some rounded sandstone in the upper part of the Old Red Sandstone in the island of Arran, in Scotland. Every one knows the millet-seed sandstone in the north-west of England; that also has probably received its rolling from desert action.

Prof. Hull: I have listened to this paper, so far as I understand it, with interest, but I confess it wants much more study than I have been able to devote to it. I would not take part in this discussion if it were not that I have to some small extent that advantage which Prof. Bonney alluded to. I have been in countries where there are sand-dunes of considerable size, and I will allude to two of them. One is the western shores of the Holy Land, and a district extending almost from the borders of Egypt, with great sandhills in the neighbourhood of Alexandria, only cut through by the Nile. It continues all along the shores of the Mediterranean, at any rate, as far north as Beirut. I confess that, after having seen the many sandhills in our own country, I was astonished at the magnitude of these great ramparts of sand raised up on the shores of Palestine, where they encroach on the land. As a matter of fact, these sand-dunes are invaders far more than the waves of the sea, and it is lamentable to see the extent of the ravages of this ever-advancing movable mass of sand on some of the most fertile tracts of Philistia. One point I can confirm from my own observation—that a small stream will stop the advance of this invader. A few miles to the north of Gaza there is a small stream coming down from the interior, running into the sea, and along its banks for a mile or two where we followed it, the great mounds of sand are absolutely brought to a standstill; the reason being that the stream carries away the particles of sand as they are deposited into the sea. Ancient Gaza is considered to have been buried beneath the sandhills which rise to the west of the modern city.

I may mention that the heights of some of these sand-dunes have been determined by the Ordnance Survey, and they rise to about 200 feet above the level of the Mediterranean. They are sometimes 4 miles in diameter, and in one part between Gaza and Jaffa they are about 7 miles in continuous length. While it is a great puzzle to me to know where this sand came from originally, I think in almost every case we can trace the origin to some local cause, and I came to the conclusion that these sandhills originally had their source in the breaking-up of the calcareous sandstone of Philistia.

Another desert that seems to tell the same story is the well-known Sahara where the sandhills have attracted a great deal of attention, especially from Professor Zittel, who has endeavoured to account for the region by the erosion of the Nubian sandstone. The Nubian sandstone crops out in a fine range of hills to the south of the Sahara, and the prevalent winds coming from the south and blowing to the north have carried the sand derived from atmospheric erosion and spread it over the desert. It has constantly been creeping on from the south, and though doubtless this desert has been a bed of the sea, still the source of the sand-dunes is probably the Nubian sandstone.

Mr. Whitaker: I cannot say that I have been in the desert, but I have been by the sea-waves and seen the sand that blows. It is, however, strange that this little island contains a tolerably fair epitome of geological formations, and we have in England even our minute deserts. In working at the geological survey in

Suffolk, I have seen sand blown inland as well as on the coast, having come across a ridge of sand which I had very little hesitation in pronouncing blown sand, from its shape and appearance. If Mr. Cornish is ever near Brendon and Thetford, I hope he will look at the sand there. If he could blow it into dunes and get it isolated, he would confer a great favour on most geologists. As a matter of fact, just a few inches of sand lead to great conjecture as to what is underneath. I have seen the sand rising up in great spouts there.

As Prof. Bonney rightly said, we would infer blown sand from finding the sand in well-rounded grains; but there are cases where it would be hardly fair to expect such rounding, for where loose sand is in tolerable profusion, you can get blown sand without much attention, as in some of the English examples spoken of. Of course, in those cases where sandy beds are exposed to the wind in fairly open country without shelter, the sand is blown about. I was told that in one case, when a lot of labour was unemployed, a landowner had the idea of covering the ground more or less with large belts of trees for ornament; he did so, checked the wind, and stopped the blowing about of the sand. There is a description of the sand flood in Suffolk in one of the early numbers of the *Philosophical Transactions*. Mr. Cornish has spoken about the shell-sand on the Cornish coast. Now, I should like Mr. Cornish to note, as he goes on—I suppose he will—the different compositions or qualities of the different sands, because it is possible that the shell-sands would hardly wear to rounded particles in the same way as other sand.

In noticing sand, I have been struck by the extremely beautiful forms sand, like drifted snow, takes. I don't know if this has been investigated mathematically, but I should like, if it could be done, some investigation made into the curve taken by wind-driven materials—light snow or heavy sand. I think Mr. Cornish made a great point when he showed how different actions will take place with light sand not previously blown and sand from which the lighter particles have previously been blown.

Prof. Bonney stated that a grain of sand required 3000 miles of travel to become rounded. [Prof. Bonney: I said Daubrée stated it.] I don't know whether this refers to sand under water. Of course, sand not under the water would not have to travel so far, and there is probably far greater friction among the particles. One hundred miles of travelling with the wind would have as great an effect, I should think, as 3000 miles under water. I am glad to find, among other things, that this paper is not to be an isolated one, but one of a series, and also to see that the author says how difficult it is to know where sand begins and pebbles end.

I am glad, too, that he has kept in view the wave-action in water, because there is no doubt the action is much the same. It is a rather bad thing very often to divorce solid from liquid. I remember a case at Southampton, where people stored loose grain in the top floor of a granary. They did not count on its acting as a liquid. It found the weakest point in the floor, poured out on to some stairs, and very properly landed itself on the floor of the Corn Exchange.

Prof. Seeley: There is very little that I can add to the remarks which have been made. I have had the pleasure of seeing some removal of sand-dunes on the coast of Norfolk. They formerly extended, as is well known from the figures given by the late Sir Charles Lyall, in a ridge of sandhills, which I visited in 1861. In 1863, when I again went over the country, the ridge had entirely disappeared, after lasting very nearly two hundred years. This is an element in the history of sand-dunes which is extremely interesting, because it shows that the process of accumulation depends upon extremely varied circumstances and unbroken continuity of action. You may have the whole process reversed, just as, on the smaller scale, you get the process of shaping a sandhill reversed, so as to modify its whole form.

The examples I have studied most carefully are those round the coast of Holland, where you have very much better examples for examination than anywhere I know in this country. One very striking feature of such dunes is that the land side is totally different from the sea side. The side towards the sea is particularly well rounded in a series of slopes; the sides towards the land are constantly concave, and the forms of the hills are concave. The slope varied according to the blowing of the sand from the sea, and the change of direction of the wind from time to time.

One element in the formation of these sandhills is the temperature of the slope of the sand which is furthest removed from the sun, because the chilling influence of that upon the air creates a downward current, which causes a deposit of the sand, and leads to a movement of sand which tends to the onward flow of the sand-dunes.

One of the most interesting series of sandhill movements I remember was published by this Society in its journal about fifteen to twenty years ago—"The Passage of Sandhills across the Desert of Gobi," and the forms there described are identical with some of those brought before us by the author to-day. The details of sandhill movement may be certainly seen on a small scale in the neighbourhood of Westleton Heath, that probably Mr. Whitaker was alluding to in Suffolk. I myself have seen exactly the same class of phenomena, on a small scale, in Holland, and in the south of Africa, on the southern slope of the New Veldt range, where there is a phenomenon of a striking kind. The shales become broken up by the action of the sun, and divided into extremely fine particles which are moved by the wind; the wind sweeps them onward so as to cover the entire surface of the country for miles with an appearance that can only be compared to the rippling of sand on the seashore. You see it many miles off, and as you come near its character is manifest; but under no circumstances have I seen this rippling take the form of sandhills in that part of South Africa.

Lord Belhaven: I thought I might make one remark about the sandhills of Bermuda. Bermuda, as the meeting is no doubt aware, is composed of coraline sand, which has been blown upon the southern portion of the coral-bank into a line of hills in the form of a horseshoe. I have had the opportunity, when excavating the soft Bermuda stone, to see the way in which the sand is lifted and deposited, very rarely in any prevailing direction. The stratification is extremely mixed; within a short distance you may come across one stratum rising to the north, then another rising to the south, and another to the east, and another to the west. These, by the action of the rain passing through, have formed into a light concrete; but you see how the different strata were formed in early days, and are now solidified into hills.

Mr. J. F. Blake: I have listened to this paper with much interest, because I have been considering the sand phenomena in Cutch, in connection with the dunes which the author mentioned. He has drawn attention to the longitudinal form of dunes. They require a certain amount of explanation, and reading through this paper carefully, I was happy to find I agreed entirely with the explanation the author gave, which is the same as Dr. Blandford's. The longitudinal dunes owe their origin to a greater velocity of the wind than is ordinarily available, in a way beautifully shown in detail by the author. I should like to get a few more details about the amount and velocity of the wind, *i.e.* what is the amount and velocity of wind necessary to produce longitudinal dunes, in relation to the size of the sand-grains? because it would be satisfactory to have that cleared up. As a matter of fact, the average rate in Cutch would be about 30 miles an hour. Are sandhills, of a height of 400 to 500 feet, raised entirely without underlying

rock? The question was raised by having to account for some very remarkable deposits of sand at a height of 700 feet in Cutch, which I have referred to the action of blown sand. I am writing a paper on the subject for the Geological Society to-morrow fortnight. Of course, to get the sand up to this height demands a considerable force of wind even in a longitudinal valley, where it would be increased. Still, we had a wind of 30 to 40 miles an hour constantly.

There are one or two points I want to ask about, although in most cases I agree with the author. He says, "One of the most remarkable phenomena attending the distribution of earthy materials by wind or water is the sorting action exercised by the fluid." Now, if I had been writing that sentence, I should have said the non-sorting action of the fluid, that is to say, that large and small particles are in definite relation to the wind. Different winds, that come at different times, land different-sized particles; by water you get small particles in one place, and large particles in another.

A little further on he adds, that the action of wind in the deserts tends to lower the general level. That is, of course, if the sand is derived from the desert itself; but if brought by the wind on to the desert itself, it may raise, and probably will raise, the level.

I would like to say a word about these fuljes, as the author has laid considerable stress on them. These little ripples he has noticed are very minute, and only observable by the careful eye; but these fuljes are described as sometimes 280 feet in depth. Now, I think it would take a strong current to hollow out 280 feet from a mass of sand. I have sometimes dug a hole in the sand to see what would happen, and have always found that the wind fills the hole up from the windward side, and does not excavate on the other side to any extent worth mentioning; it does not move onward. Do these fuljes move onward? If so, this theory is correct; but if it is not so, it can hardly be correct.

One further point I am glad to see noticed in diagram 23, viz. the action of sand near a hard elastic obstacle—one of the phenomena of sand-dunes, the dip of which, on the side towards the obstacle, is a very marked feature. As he says, any obstacle you may put up is always separated by a hollow from the sand-dunes. The stratification of the interior of the hollow is very much like the stratification of ashes round the crater of a large volcano. I should like to ask the author also whether he has ascertained, or will ascertain, if there is any relation between the motion of a sand-glacier and the average velocity of the prevailing winds; also, whether he can determine, from the shape of the dunes, the direction of the prevailing winds of a district. It might be interesting to find out the prevailing direction of wind when meteorological observations could not be made on the spot.

I must add that I am delighted with Mr. Cornish's paper.

Captain A. H. McMahon: I should like to say a few words, although I did not come prepared to speak. In my recent wanderings in the deserts between India and Persia, I have traversed upwards of 1000 miles of sandhills, and have observed sandhills under various conditions. I saw every kind mentioned by Mr. Cornish. First of all, on the level plains we had examples of primary sandhills, which he calls "barchanes," which may have been primarily caused by an obstacle. We found these barchanes only on flat level plains, and invariably in the shape of a horseshoe, with a gradual slope on the windward side, and a hollow with a steep slope on the lee side. I have watched the action of the wind during a storm on these barchanes, and also on the "fuljes," of which we saw every kind and variety, both of horseshoe shape and square shape. These latter we found in the higher sandhills, generally where the sand-dunes were eating up a mountain range. In some cases we found mountains altogether covered up by sand. Others had sand

banked up against their sides as high as 1000 to 2000 feet above the level of their base. These sandhills, or sand-mountains as many of them should be called, were of every form and shape, among which were all the various shapes described in Mr. Cornish's paper. We found fuljes all over these higher slopes, more especially in places where the wind-swept sand had formed high valleys between mountain ranges. We found, as I said, fuljes also of a square shape. I remember a series of these in a high sand valley near Amir Chah. They must have been from 100 to 200 feet deep in the centre.

Mr. Cornish: Had they two slopes, steep and gentle?

Captain McMahon: The square fuljes were formed by two high parallel ridges of sand, with the hollow between them cut into squares by crossbars of sand. As far as I remember, there were not two slopes, a steep slope and a gentle slope, as was the case in curved fuljes. All four sides had the same slope. There were in places more than two parallel ridges of sand, and therefore larger series of square fulges. I had the opportunity, on more occasions than I cared for, of watching sandstorms, and I have watched their action on both fuljes and barchanes. I have sat on the edge of a barchane, and seen the wind sweep off the sand from the top, while in the hollow on the lee side beneath the current of sand blowing off the top, I used to see an eddy of wind sweeping the sand on the slopes of the hollow in a curved current more or less at right angles to the upper current. When the wind stopped, you could then clearly see that the sand-ripples on the windward slopes were at right angles to the direction of the wind, while those in the hollow on the lee side were parallel to the direction of the wind. The same action took place in the fuljes; but whether the scooping action of the lower eddy of wind is what originally caused the fulje, or whether it only explains how the hollows are kept empty of sand, I cannot say.

The President: I should like to ask Mr. Cornish what is the plan of the barchanes, or, as we call them, medanos, and whether they form themselves in regular lines (he mentioned stripes), or whether they are formed accidentally by some obstacle which has obstructed the movement of the sand. I have seen a good many of them when wandering about in Peruvian deserts, after losing my way, and should have noticed any regular lines. I saw them scattered in various directions, and therefore came to the conclusion that they were formed by some such obstacles as a dead mule or a stone, where the sand stopped and gradually formed into these horseshoe forms. If this is the case, it is not necessary to come to the conclusion that they are formed by the fall of the heavier grains first, in which case they would be in regular order according to the strength of the wind. A point of great practical importance is the devising of a method of stopping the sand and making the dunes permanent. I fancy in Holland this is done by planting strong grass called helm. I noticed in one of the northern deserts of Peru, where the medanos, or barchanes, are of white sand, there were small patches of apparently whiter sand on the top, and I was told that these were caused by innumerable spikes of amaranthous plants, which keep pushing up their spikes to get above the sand. These had the effect of stopping them, and I am told that in parts of the desert of Piura they may be considered as almost permanent, and are seldom moved.

I should like also to know if Captain McMahon heard the curious musical sound among the sand-dunes in the early morning.

Captain McMahon: There is such a desert just north of the Helmund where there is said to be a curious sound made by certain sandhills.

The President: I think I remember, in his book on the 'Source of the Oxus,' that Wood made a long journey in order to visit some barchanes emitting musical sounds.

Captain McMahon: Sir R. Pollock's party visited one of these sound-giving sandhills.

The President: And similar phenomena are mentioned in the Gobi desert? I think we ought to congratulate Mr. Cornish, for it must have been very agreeable to him to have made observations on the sea-coast of Cornwall which afterwards explained these phenomena, called *fuljes*, on a larger scale in the deserts of Arabia. Probably he would like to answer some of the questions.

Mr. Cornish: In reply to Mr. Whitaker's question as to curves formed by sand in the neighbourhood of obstacles, these are very interesting and beautiful, and I should like to show figures of them to Mr. Whitaker, if he will afford me an opportunity of doing so. I have not yet had an opportunity of examining snow-drifts properly, but I hope to take, as soon as possible, an opportunity of examining its tactics.*

The quantitative data for which Mr. Blake asks are, unfortunately, not at present available. Such data, if combined with my plan of treating sand-dunes as waves, would, I think, render the tactics of blown sand susceptible of mathematical treatment.

With regard to the sorting of sand, that process goes on perfectly in ripples. In the dune you get everything mixed up, because it registers the impress of many changing winds; there is nothing definite until you examine it in the light of the phenomena of ripples. The time taken in the formation of dunes is too great for observations.

As to whether fuljes move, if you get them sufficiently large you will never be able to watch their movements. These places in Arabia have only been visited from time to time. It would take a very big storm to shift it a foot; there is no one to tell you whether it has shifted a foot or not. But I don't demand that the winds in Arabia shall be so strong as to dig out holes 250 feet deep in the sand. I think a merit of my explanation is that it does not demand that the wind should dig these things out, but only keep them open; that does not demand quite so much violence of wind as would be required to dig a hole and gouge it out to the bottom.

I have been waiting for an opportunity of comparing a volcanic cone with dunes, but my opportunity has not yet arrived. The inside of the crater, if composed of scree material, corresponds to the lee side of the dune; the other side corresponds roughly, at any rate, to the windward side of the dune, so that one would expect a sloping side and a steep side. This is very similar to the form shown in Fig. 23.

I should say dunes certainly show the direction of the prevailing wind. I don't think there would be much difficulty in telling the direction of the prevailing wind in a sand-dune tract. You can make it out from loose sand that is not fixed by vegetation.

The observations of Captain McMahon are extremely interesting. I think I have worked out the horseshoe form of fuljes, and I shall be glad if he can give me more information in regard to the square form.† The barchanes, I believe,

* Some slight observations, which I have since made, show curious differences between the tactics of drifting snow and those of blown sand.—V. C.

† I am able to explain these square holes from the further description which Captain McMahon has kindly given me. They occurred in a mountain pass where the wind was focussed, and the sand-supply was concentrated to an even greater extent. The first action was, evidently, the laying down of longitudinal dunes. Afterwards, when the pass was thus partly blocked, the transverse dunes formed across, making a grid pattern with the cross-bars lower than the longitudinal bars. It is easy to see

dot the desert plain without any order, sometimes, I think, one behind the other at various distances, but generally with no particular arrangement. Of course, this suggests the idea that there must have been something there to stop the sand, but it is noticeable that people are seldom able to produce these obstacles or see them.

It is extremely difficult to cover up a hard elastic obstacle. Mr. Palgrave relates how a few camel-loads of stones were put down in the eastern part of the Nefud of Arabia, and two or three years afterwards this small heap of stones still stood out in a land of shifting sandhills. A hard elastic obstacle of that kind will scour the sand away, even as in seas and rivers, where around rocks, instead of accumulation, you get erosion. I think the barchane may be easily deposited without the intervention of an obstacle. The heterogeneity which I referred to is heterogeneity of wind—illustrated by the observations made at Hayle. The sand would drop as a whole, and would form a nucleus which would speedily grow.

Captain McMahon: One very important point about the barchanes was that we only found them on hard level plains, not in soft sand plains. I came to the conclusion that they were first started by sand being blown up against some obstacle. The plains we found barchanes in were hard plains of black gravel, and we used there to find barchanes in numbers all over the place, not in lines one behind another or in any regular order, but in groups of irregular shapes. One particular lot were noticed by Sir Charles MacGregor in 1877, and he particularly described them in his 'Wanderings in Beluchistan.' I examined these nineteen years afterwards, and they answered his description to a T, and that shows that they do not change position rapidly.

Mr. Cornish: You think they are formed by obstacles on hard level plains, and are never found on the soft sand; then I must hedge to this extent—I think my observations show that barchanes can be formed without a nucleus of any kind, but it may happen that the sand depositing round a bush, whose branches cheat the wind, may be shaped by the wind into barchane form.

The President: With regard to the prevailing wind, I may say that throughout the deserts of Peru the cusps of the medinos all bend in exactly the same direction.

We have had a very interesting and suggestive paper, for which we have to thank Mr. Cornish. As he is continuing his researches, I trust before long it may be repeated, and we may have a second such paper. We have had an unusually exhaustive and interesting discussion, and I am sure the meeting will pass a hearty vote of thanks to Mr. Cornish for his paper.

ANCIENT TRADING CENTRES OF THE PERSIAN GULF.

III. PRE-MOHAMMEDAN SETTLEMENTS.

In point of time, after Siráf and Kais, follows the important and interesting city and state of Hormuz, on which I have written formerly. I propose, in this paper, to take a general view of the earliest commerce, and give a description of some of the most ancient coast settlements in the Persian Gulf. Their history is little

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how, if the accumulation of sand proceed, the final stage of this formation would be rows of rectangular pits in a plateau of deep sand. The formation of *bars* between *stripes* occurs also in the sand of tidal rivers where, as Prof. Osborne Reynolds has pointed out, the channels between the well-known longitudinal shoals are laid down in transverse ridge and furrow by the rippling action of the tide.—V. C.

known, and they may almost be called pre-historic, as the early history of Persia is extremely vague, and dates can only be occasionally assigned by reference to events recorded also in Greek or other history.

Considering the comparatively easy coasting navigation by the gulf route, it appears (as might be expected) to have long preceded the Red Sea as the channel of communication with the East, and it may well be that the early ascendency of Babylon and Nineveh arose from this circumstance, and that, later, the adoption of the Red Sea route by the Romans led to the wealth and importance of Alexandria.

Gibbon suggests that sea communication was initiated in consequence of the overland caravan route through Central Asia being closed by disturbances, and refers it to the time of the outbreak of the Huns in the first or second century of our era. It is, I suggest, more probable that it was long anterior to that period, and that Dean Vincent's conclusion is nearer the fact, when he states that the communication with the East is the oldest in the world, and older than Moses or Abraham. Dr. Heeren * observes that we can entertain no doubt of a considerable navigation of the Persian Gulf, not, however, limited to that sea, but extending to large and distant countries, before the age of the Persian empire.

We have a suggestion of navigation in the earliest times, in the myth † (preserved by Berosus) of Oannes (Hea), the fish god, who came up from that part of the Erythræan sea which borders on Babylonia, to teach the inhabitants of that country letters and sciences and arts of every kind. This seems to indicate the arrival, in ships, of strangers of a higher grade of civilization, who came to be regarded as supernatural beings, as was also the case with the discoverers of America. Where these strangers came from can only be matter of conjecture—it might have been even from China—but Sir H. Rawlinson considers they were a dark race not belonging to the Semitic family.

Rawlinson also suggests that the Phœnicians may have originally come from the Bahrein islands, and extended westward to their settlements on the Mediterranean littoral at least five thousand years ago. There is, he considers, no direct evidence of this connection. On these islands tumuli and other remains of probably Phœnician origin have been lately discovered and described by Mr. Bent. Other tumuli,‡ of Babylonian age, with a cuneiform inscription, were discovered by Captain Durand on these islands. They have been identified with the Tylus and Aradus of Ptolemy and Strabo. The latter authority states, however, that they are two islands, with temples resembling those of the Phœnicians, and that they are ten days' sail from Teredon (near the mouth of the Tigris), and one only from the entrance of the gulf at Macæ (or Musandam). If this be so, they would have to be placed among the islands near the entrance of the gulf, where, however, no such ancient remains have been observed. Ptolemy also places them near the island of Voroctha, which is, doubtless, that now known as Kesm or Kishm, and formerly called Brockt; and he further places them near the Asaborum promontorium and Armuza, or old Hormuz, on the main land. The Asaborum promontory is certainly Musandam. Strabo also says the Phœnicians had a settlement called Sidon, or Sidodone, visited by Nearchus, and this has been located near Ras Yarid.§ He also states that from these places they moved to establish themselves on the Mediterranean, transferring the old names to the new settlements.

* 'Hist. Researches into the Trade, etc., of Antiquity.' Translated by D. A. Talboys. 1833.

† Sir H. Rawlinson on "The Islands of Bahrein," *Roy. Asiat. Soc. Jour.* for 1880; p. 202.

‡ Described in the *Roy. Asiat. Soc. Jour.* for 1880, p. 189.

§ On the Persian coast, not far from Kishm island.

Strabo's information about the Persian Gulf was admittedly taken from Eratosthenes, who again was chiefly dependent on the narrative of Nearchus and his companions. The extent of the very early voyages is a matter of speculation, it is probable it may not have extended beyond Ceylon. From the records of Fa-hian * of the fourth century, it is clear that ships from China came as far as Ceylon, and there exchanged merchandize with the Arab vessels, and this is confirmed by the account of Cosmas,† who wrote between 530 and 550 A.D.

GERRHA.—Of this ancient emporium on the Arab coast, which flourished from very early times until after our era, the very site is disputed. The Rev. C. Forster ‡ supposes it to have stood at the south end of the deep bay south of Bahrein, where ruins were reported by the first surveyors of the gulf; but no account has been given of these, nor is it certain they were visited. It is more probable the site was near the present town of al-Katíf, on the main land opposite the north end of Bahrein. Captain Durand (*op. cit.*) mentions ruins still retaining the name of Geréyeh near this place, but they have not been explored. Rawlinson is of opinion Gerrha represents the Ophir of the Bible. This part of the sea presents an interesting field for archæological research; the time at our disposal during the survey was very limited, and fully occupied with the necessary observations.

Strabo states that it stood in a deep gulf, belonging to Chaldæan exiles from Babylon, 200 stadia from the sea, and 2400 from either Teredon or Icarus island (probably Failakah)—it is not quite clear which. Heeren (*op. cit.*) supposes it was founded as a depôt by Chaldæans, and that its most flourishing period was after the destruction of the Babylonian commerce by the Persians. He refers to it as the one city on the Arab coast, and as probably near al-Katíf.

BAHREIN.—These islands are referred to in many old writers of Mohammedan times, as the centre of the celebrated pearl fisheries. Of earlier times, Colonel Taylor § says that the earliest inhabitants are asserted by some to have been ancient Persians, who, after long residence, adopted the language of the nearest coast; but by others they are said to be descended from the Arab tribe of Thamud (1900 B.C.), who were driven out of Yemen and migrated into Awal (or Bahrein). In A.D. 420 the idolaters still held the islands, but in 615 Bahram, of the Sassanian dynasty of Persian kings, possessed himself of it, and nominated a governor, who retained the country till the Mohammedan era, when the government reverted to the original people. This account, which does not quote any authorities, does not refer to its subjection either to Kais or Hormuz. Of its later history I hope to write hereafter.

TEREDON, called by the Greeks Diridotis, appears to have been the great Babylonian port; it is referred to by Ptolemy, who places it on a delta between an eastern and western mouth of the Tigris (or rather Shat-al-Arab). Dean Vincent assigns it a position on the Khor Abdallah; but it seems more probable it stood near the old town of Zobair, which lies southward of Basrah, on a channel, said to be artificial, leading into the Khor Abdallah, and probably once connected with the river. It is, I believe, first mentioned as the port at which Nearchus first touched at the end of his adventurous voyage, and is described as a mart, the centre of the commerce of Arabia.

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* 'Voyages anciens et modernes.' E. Charton. Paris: 1854.

† 'Cosmas Indicopleustes. Relation de divers voyages.' Thevenot: 1696.

‡ 'Hist. Geogr. of Arabia.' 1844.

§ 'Selections from the Records of the Bombay Government,' No. xxiv., dated 1856. Brief notes, etc., prepared in 1818 by Captain R. Taylor, Assist. Pol. Agent in Turkish Arabia.

In 'Ancient Fragments'* Cory says that Megasthenes, quoting from Abydenus, records that Nabucodonosar built the city of Teredon to check the incursions of the Arabs. I do not know that any mounds or ruins have been identified as the site of this place; but the country outside Basrah and far to the southward is full of remains of ancient irrigation canals, and of mounds, which deserve further investigation.

According to Dean Vincent, Teredon declined after the Macedonian conquest, and was superseded by Obollah, called by the Greeks Apologus, probably under the Arsacides. Strabo refers to Apologus at the head of the gulf, but does not mention Teredon. Obollah was in its turn superseded by Basrah, which was founded about A.D. 636 under the Kaliphate of Omar. Of Obollah some memory is preserved in the name attached to a canal on the right bank of the river below Basrah, and nearly opposite the Hafar river or canal. This is mentioned by Abulfeda (A.D. 1274–1331).

Ganáwah.—This is another of the forgotten maritime cities. The present village is about half a mile from the sea, about 35 geographical miles northward from Abu-shahar (Bushire); the only feature it possesses is a picturesque tomb or mosque with a spire, of considerable antiquity. Inland of the village the ground for upwards of a mile is covered with mounds, the remains of an ancient city, so completely fallen to ruin as to leave no masonry standing. About a mile inland from the village is a large river or watercourse, generally nearly dry, which has a channel about 80 yards wide among the mounds, with steep clay banks, its bed being 10 to 15 feet below the surface-level. It runs to southward and then to westward, entering the sea about a mile and a half below Ganáwah, and is now called Khor Khalíl. It is tidal near its mouth, and some coasting trade is still carried on by small boats. Among the mounds we came across two walls, circular, about two feet in diameter and 20 feet deep; they were coated inside smoothly with fine lime or gypsum, and in good preservation, having been, we were told, then recently discovered. In the sections of ground exposed by the action of the watercourse are seen the walls of ancient buildings, sometimes projecting, somewhat below the present surface-level; detached shapeless masses of masonry also stand, or lie overturned, in the bed of the torrent. The masonry is good, the cement being better preserved than the stones. In many places burnt bricks have been used. Sections of floors of the houses are seen as horizontal lines about 5 feet below the surface, consisting of a concrete of lime and broken stone. We could not hear of any inscriptions or coins having been found, and, although the mounds are strewn with fragments of coarse local pottery, I could not find any china. The only curious works of art were circular discs of baked clay, with a groove round the circumference, which were plentiful, and, we were assured by the people of the place, were intended for slingstones. I cannot suggest any other use for them. Some of these were sent to the Asiatic Society of Bombay. They were rather large; I should estimate, 6 inches in diameter.

The notices of this place are few, and throw little light on its history. Sir Henry Rawlinson† states that under the Achæmenians the port of Dalaku, the capital, was at the mouth of the Granis. It is possibly the Taoce of Ptolemy, on the Rhogomanes river, which is shown on his map as rising near Persepolis. The Periplus has Taoke on the river Granis. I can find nothing about its commerce; but, from the size of the little river and absence of any porcelain fragments in the mounds, surmise it was local only, and not with the far East. In Abulfeda's

* By Isaac P. Cory. 1832.

† Vol. i., *R.G.S. Proceedings*, 1855-57.

geography * it is mentioned that Jannabah (doubtless Ganawah) is one of the ports of Fars, "almost entirely ruined." The Sinis of Yakut, "to-day in ruins," must, I think, be sought at Khor Sini, further to the northward, where ruins are stated to exist, but which I have not visited. Ebn Haukal † only says of this part: "Sinis is the port of all Pars or Farsistan; from thence the seashore winds to Bijerm (?). Between Jennabah and Bijerm there are groves and meadows and villages, and the air becomes very warm here."

RISHAHR.—Here are the remains of an important city of great antiquity, where cuneiform inscriptions have been found. It stood about 5 miles to the southward of Bushire, near the centre of the small peninsula of which Bushire occupies the northern extreme. It is in a bay just below a little projecting rocky point, which affords some shelter to boats in north-westerly winds (the prevailing direction). The principal remains are the mounds of a square citadel, and a second mound at some little distance. The former is rectangular in plan, about 400 yards in length and breadth; one side is formed by the sea-coast, here a low cliff, 30 to 40 feet high; at each end are the remains of a spur or jetty thrown out into the sea. The other three sides are earthen ramparts, rising 20 to 30 feet above the level of the ground, of great thickness and with steep slopes; the material has been derived from a great moat surrounding all three sides, which is 70 to 100 feet wide, and still about 20 feet deep. It is in part cut through the rock, which is soft and easily worked. The interior of this vast quadrangle is covered with shapeless *débris* and mounds, with much broken pottery and many splinters of cornelian. I could find no grounds for the assertion that the Portuguese had anything to do with its construction; it in no way resembles any of their work. The remains of the town extend over more than a square mile around this citadel, with mounds and many old walls. The second mound, about 30 feet high, stands about 2 miles off inland of the mounds, and, on being dug into, disclosed a regular structure of burnt bricks, in regular courses, with cuneiform characters stamped on each, which have been recognized by Sir Henry Rawlinson ‡ as of the time of Sennacherib. He calls it the temple of Tirhakeh, the king of Ethiopia, and also says that in the third and fourth centuries it was the seat of the Christian metropolitan of Persia, and Johannes, the then incumbent, sat at the Nicean Council in 325 A.D.

In Yakut § it is stated that it existed before Islamism, and was inhabited by writers who registered things relative to the sciences; and, further, that a great battle was fought here during the Moslem invasion, under the general of Omar, El Hakam el Thakafi, in which the Persians were routed and the town taken by assault, and that, owing to the energetic resistance of the Persians, it was as celebrated as the great day of Kadesia. After the conquest the place declined, but subsequently attained some importance under the Mohammedan rule.

Sir W. Ouseley ‖ says, on the authority of old persons of the neighbourhood, that Rishahr formerly contained about 700 families, employed in cutting and polishing cornelians and other ornamental stones. Also that jars bearing sculptural devices, beads, rings, coins, and arrowheads, all of which were attributed to the Gabrs, were dug up.

He says that Hamdallah Cazvini dates the foundation of the place from Lohrasp

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* Translated by M. Reinaud. Paris: 1848.

† Translated by Sir W. Ouseley. 1800.

‡ Vol. i., *R.G.S. Proceedings*, 1855–57.

§ 'Dict. Geogr. de la Perse from Yagout (born 1178, died 1229).' By C. Barbier de Meynard.

‖ 'Travels in Various Countries,' etc. London: 1819.

of the Caianian dynasty (about 500 B.C.), and that it was rebuilt by Ardeshir Babakan (about 230 A.D.). This Arabian geographer (of the fourteenth century) adds that it is a city or town of middling size on the shore of the Persian Gulf, where, from extreme heat, the air is impure and unwholesome, and most of the inhabitants apply themselves to commerce by sea.

Edrisi * (twelfth century) only mentions it as "a small town, but populous, and has numerous dependencies." Thevenot (seventeenth century) says it has a little port, and calls it an island. Its trade was transferred to Bushire during the eighteenth century. What the trade was, or with whom, I have not traced any indications.

Nearchus' account is not very clear. It is supposed that the station Mesambria was near this place, he calls it a peninsula, with gardens and fruit-bearing trees of all kinds, which would be appropriate; but also mentions the mouth of a river, which would seem to point to Halila bay, at the southern end of the peninsula, in which is the entrance of a large creek.

Probably the most ancient remains, discovered by Mr. Bruce, the British resident, also by Sir W. Ouseley and others, are certain funeral urns of baked clay. They were long in proportion to diameter, and the lower end was pointed, and they contained crumbling human bones.

On the highest part of the peninsula stands an old mosque, now ruinous, and called Imámzádah. It is not remarkable in appearance, and I did not learn anything of its history. It stands within the circuit of the ancient city. There is also a small domed tomb, containing a cemented tomb, of a Mohammedan saint, 9 feet in length. The people believe this to have been the stature of the holy man, and it is called Shish-gaza (*i.e.* Six-ells).

There are some wells to northward of the mounds, which have the best water on the peninsula; they are attributed to Shah Bahman, and are still called Chah-i-Bahmani (chah = well).

There are many fruit gardens among the ruins. Excellent grapes and other fruits are grown: the vines generally grow in old wells. I was not fortunate enough to find any curiosities, but the fragments of cornelian mentioned corroborate Ouseley's account of the gem-cutting industry.

EGYPT AND ABYSSINIA.

By Professor LEO REINISCH.†

Egypt and Abyssinia, with their ancient civilizations, stand in a position of marked contrast with the rest of the native states of Africa, characterized as they are by a complete absence of culture. Whilst for this reason the latter fall easily into the hands of the civilized states of Europe, the former have down to the present day borne a certain stamp of independence, which, in the case of Abyssinia especially, shows itself in the possession by the people of a real national spirit.

Both Egypt and Abyssinia lie on the shores of the Red Sea, and both are in touch with the Nile. This similarity of geographical position brought them, even

* 'Geogr. d'Edrisi.' Translated into French, with notes by P. A. Jaubert. 1836.

† Abridged report by Dr. K. Peucker, of a lecture delivered by the author at his inauguration as Rector of the University of Vienna. Professor Reinisch is well acquainted, from personal observation, with the countries dealt with, and is one of the best authorities on all linguistic questions connected with them.

in ancient times, into manifold relations with each other, although the nature of the two countries has influenced their development in diametrically opposite directions. Both states are suited by nature for a high degree of culture—Abyssinia by reason of its elevated and healthy position, which favours work, and of its plentiful supply of rain; Egypt, on the other hand, by reason of the yearly fertilizing overflow of the Nile.

Bounded on either side by the lifeless desert, the Nile valley is of surpassing fruitfulness wherever the fertilizing stream reaches. The irrigation of the valley demands a strictly organized system of labour, on which the whole people must bring their united strength to bear, whilst the open nature of the country gives no scope for insurrection, and the wide desert on either side renders the flight of the disaffected or of rebels impossible. These natural conditions brought it about that more than 5000 years ago the government of Egypt took the form of a despotic monarchy.

This despotism, whilst it wrought wonders for the material prosperity of the land, and for the advancement of science and art among the upper orders, entirely robbed the common folk of their free development. From the most remote antiquity down to our own day, this naturally favoured land has witnessed no social change or advance. Dynasty has followed dynasty without any alteration in the condition of the people, whose destiny has been shaped for them entirely without their own intervention. Nor has religion done aught to break the yoke of slavery. Hence the conquest of Egypt has been an easy task for foreign nations. With a people little interested in the fortunes of their rulers, it is no wonder that in turn Ethiopians, Assyrians, Persians, Macedonians, Romans, Arabs, Turks, and Franks have been able to make themselves masters of the country. Egypt can, in fact, remain an independent state only so long as no foreign enemy covets possession of the land.

Very different is the case in Abyssinia. The broken nature of the ground, and the fact that the several provinces are separated one from the other by steep, rugged, and often impassable mountains, or by deeply cut ravines, puts the greatest obstacles in the way of a united government, and favours the formation of a smaller and more independent class of states. For the same reason the old inhabitants of Abyssinia, who are related by blood with those of Egypt, have been formed into a number of separate races with distinct languages, whilst their kindred in Egypt had, on the contrary, by reason of the natural character of the country, become moulded into a homogeneous people with one language even before the dawn of history. Various circumstances, however, especially the introduction of Christianity into the country in the time of Constantine the Great, have so acted on the people of Abyssinia, that even there the inhabitants of the separate provinces have likewise in a measure become united, on a federal basis, into a single political organism.

This kingdom has gained strength and power of resistance, not merely from the protection afforded by its natural features, but more than all from the possession of a supreme dynasty, to which the various kings and chiefs (mostly hereditary) of the separate provinces are subordinate, and of a common state language, the so-called Amharan, which every Abyssinian, to whatever race he may belong, strives for his own advantage to acquire as perfectly as his own mother-tongue. These two factors have so operated, in spite of the various interests represented and the many separate languages current, as to develop a general national spirit in Abyssinia. To give an illustration: if one asks an Amharan, a native of Tigré, an Agau, or a member of any other of the separate peoples, to what nation he belongs, he will answer, "I am an Abyssinian," and a more particular inquiry is necessary to elicit

the information that he belongs to the Amharans, the Agau, or whatever it may be—although there is no nearer relationship between the two peoples just mentioned than there is, to take an instance from Europe, between the Germans and the Slavs. Thus, in time of danger from without, each man capable of bearing arms, no matter to what race he may belong, is ready at the call of the emperor to seize his weapons and assist to defend the kingdom from the attacking foe.

The inscriptions found in the country throw much light on its history and on the national development of writing and language under Greek and Christian influence. Only such points, however, are here touched upon as are of special interest from the point of view of the geographer, and in relation to the human side of geography. One such point is the question of the place of origin of the *Geez* idiom, which, Semitic itself, has lent many words to the Hamito-Abyssinian tongue, and of the time when it prevailed in Abyssinia. The oldest manuscripts which have come down to us date from a relatively later time—the thirteenth century—and belong to a second golden age of Abyssinian literature. The Ethiopic speech, or *Geez*, has proved to be of Arabic origin, but shows so many divergencies that it was long before its genealogy could be traced with precision. Only since the discovery of the Sabæan writing and speech, and especially through the recent discoveries of Mr. Theodore Bent, has it been possible to elucidate and determine the original connection between Abyssinian and the language of South Arabia, both as regards writing and speech. From the inscriptions which have been discovered in Abyssinia, it can be seen that Sabæan emigrants from South Arabia brought with them their writing and language to Abyssinia, and that these became gradually modified and acquired their later stamp of individuality. A South Arabian origin must also be assigned to the ancient artificial dams still to be seen, the system of terrace cultivation, and the peculiar obelisks with pictures of sun and moon, which differ in form from those of Egypt.

The cause which induced the Sabæans to cross over into Africa is not far to seek. The Sabæans held the Central African as well as the South Arabian trade in their hands from the most remote antiquity. Already in the first book of Moses (x. 7), Seba is put down as the son of Cush, whereby the Sabæans are even then designated as a people settled in Africa. Gradually they obtained control of the whole trade of the Levant, and passed on the products of India, Arabia, and of Africa, from the spice-lands of the Somali coast to Meroe, then the emporium of trade with Central Africa, to Western Asia and Egypt. It was not, however, the case that the Sabæan kingdom itself carried on the Levant trade as a state undertaking, but it was a company of Sabæan merchants that aimed at the commercial exploitation of East Africa. The British East India Company and the modern Chartered Company of South Africa had their prototype one thousand years before Christ in the Sabæan African Company. It bore the name *habašat* (*i.e.* association or company), the same from which the modern appellation Abyssinia is derived. This company subsequently broke away from the Sabæan mother-country in Arabia, and founded an independent kingdom in East Africa, which in later times even entered into hostilities with the older state.

This Sabæan trading company seems to have included a good proportion of Jewish merchants, who had wandered for purposes of trade to South Arabia in the time of the first Jewish kings, and now extended their operations to East Africa. To these Jews was probably due the hold which the Mosaic religion acquired in the country, as is shown not only by the tradition of the descent of their mythical king Melinek from Solomon and the Queen of Sheba, but by the fact that at the present day over a million souls in Agaumeder and other provinces profess Judaism, and that certain Jewish customs, such as the distinction between clean and unclean

ments, still prevail even among the Christian population. Yet after the fifth century Christianity made rapid progress, so that Cosmas Indicopleustes (520 A.D.) could already speak of Abyssinia as a Christian power.

Until the thirteenth century our information respecting Abyssinia is scanty and mostly unreliable. But inasmuch as the second flourishing epoch of Ethiopian literature fell at this time, whilst in the intervening centuries the lands of Shoa, Gojam, Enarea, Harar, Gurague and Kaffa were Christianized and in part incorporated into the Abyssinian Empire, we may conclude that Abyssinia pursued her civilizing mission, and that her influence extended to the far south. This state of high culture, which was maintained down to the fourteenth century, was undermined by the advance of Islam, which, having spread beyond the limits of Arabia over the greater part of Asia and over North and East Africa, began gradually to seriously threaten Abyssinia also.

The occupation of Syria and Egypt by the Arabs obstructed both the sea and land routes from Abyssinia towards the north, and ruptured the tie with the Christian mother-church, so that the Ethiopian realm was henceforth removed beyond the influence of Western culture. But beyond this, Islam sought to bring Abyssinia itself into subjection. The coast-lands of the Red Sea, as well as Harar, Enarea, Algeden, Barka, Mensa, and Bogos fell little by little into Mohammedan hands, and Christian Abyssinia has been completely hemmed in by Islam; but, thanks to the spirit of her people, and to favourable circumstances, she has maintained her own natural boundaries intact down to the present day.

The last Mohammedan aggression took place in 1876, when 3600 Egyptian troops attempted, without previous declaration of war, to overrun the province of Tigre in order to bring Abyssinia into subjection to the Egyptian state. Professor Reinisch was at the time on a journey to Abyssinia, and witnessed the patriotic spirit which inspired the people. On the selfsame day that the Egyptian troops began to land at Massawa, swift messengers carried the news thence into the interior. From hill to hill blazed the far-seen beacon fires, and war-cries rang throughout the provinces of the kingdom. On the following day the centres of population already resembled military camps. Priests and monks were everywhere preaching a holy war for the defence of the cross and the fatherland. Without military summons or recruiting of volunteers, all the able-bodied men of their own accord got ready their guns, swords, and lances. Women and slaves looked to the supply of provisions, and within a week 20,000 well-equipped men turned out from the province of Hamasen alone, to occupy the mountain pass towards Tigre, before the Egyptian troops had left Massawa. The outcome of the war, so fatal to Egypt, is well known. It gave the immediate impulse to the events which finally led to the occupation of Egypt by Great Britain.

As regards the probable destination of Abyssinia, Prof. Reinisch gave it as his opinion that—at least within a measurable time—it will certainly not share the fate of the Egyptians. They have been for centuries a nation of slaves, the Abyssinians a race of freemen. The conquest of the country by a nation capable of bearing the great expense necessary is of course possible, but it may be safely said that it is a much lighter task to conquer Abyssinia than to govern it afterwards. For, in spite of the fertility of certain provinces, it is to-day a poor country, having been exhausted by its wars. To bring back its prosperity, the blessings of a secured and lasting peace are urgently needed.

In order, then, that the great natural riches of Abyssinia may be thrown open to European trade and industry, there is no need of a war, or of a costly establishment of sovereignty over the land. The old Sabæans, and in after-days the Greeks, never went to war with Abyssinia, yet the mother-countries were enriched by its

treasures. In return they bestowed on the Abyssinians the blessings of culture and of a firm political status. The same method is to-day the only proper, and in fact possible, one for gaining over Abyssinia to European interests; and it is now so much easier than formerly, inasmuch as we have to do at present, not with rude barbarous hordes, but with peoples possessed of a political organization and in great measure Christian.

By securing firm friendship with the actual rulers, and by fostering trade and commerce, industry and agriculture, Abyssinia may be enabled to take her place on an equal footing with the nations of Europe within a few decades. The immediate advantage of this closer connection will naturally benefit that state which dominates the course of the Nile and the approaches to the Red Sea.

THE MONTHLY RECORD.

EUROPE.

The River System and Watercourses of Switzerland.—Our oldest honorary corresponding member, Prof. Paul Chaix, of Geneva, has sent us the following note on the watercourses of Switzerland: A Federal hydrographic office has, with the help of some Cantonal governments, spread over the territory of Switzerland a net of limnimetric stations, where observations on the slope, depth, discharge, width, and variations of the watercourses are regularly carried on, and has for the last twenty years published half-yearly tables, the working out of which will be a task of some length and difficulty. The present report * is the result of observations, bearing, from a special point of view, on that part of the basin of the Rhine included within its three sources and its meeting with the river Tamina, near Ragaz, fifteen limnimetric stations having been established on its area. Their height has been measured by a survey of precision from a horizontal line cut, by order of the late General Dufour, on a colossal granitic boulder rising in the harbour of Geneva, called *Pierre du Niton* (Neptune), marked with the letters N.P.R.P.N., and supposed to be 376·86 metres above the level of the sea. The depth of the water in the cross-sections has been carefully measured at every metre of its width, as well as the height and profile of the banks, to a distance from the actual immersed bed that will allow the immersed cross-section at any given rise or fall of the level of the stream to be calculated. The engineers have been at the trouble of measuring the horizontal surface of the watershed of the most insignificant tributaries of the Rhine, such as they are, when divided by horizontal curves 300 metres from each other. The whole surface of the above-given region is thus found to be 4454 square kilometres, out of which 1020—above 2400 metres from the level of the sea—may be reckoned as belonging to eternal snows; 167 square kilometres only, however, are ascribed to actual glaciers and to the *névés* where they originate. Of the whole surface 1039 square kilometres are, moreover, covered with rocks and shingle, 787 square kilometres with woods and plantations, 4 only with diminutive lakes, leaving for agriculture 2463 square kilometres of poor soil. The patient labour of the engineers gives us the surface and extent of watershed of ninety-four tributaries of the Vorder Rhein, of one hundred merging in the Hinter Rhein, and of seventy-nine more tributaries of the united streams between Reichenau and Ragaz—a total of

* 'Régime des Eaux en Suisse. . . . Travail exécuté par la Section hydrométrique de l'Inspectoral fédéral des travaux publics, 1896.'

273; out of which the Medelser Rhein (Middle Rhine), the Glenner, the Plessur, the Landguart, and the Tamina are alone of any importance. The limnimetric measurements of the stations give a width varying between 24 and 43 metres, with a maximum depth of 0·53 metre and 1·0 metre only, increasing, after their union at Reichenau, to a width of 42 and 72 metres, with a maximum depth of 0·59 metre and 2 metres.

Explorations in North-Eastern Iceland.—To the last number of *Petermanns Mitteilungen*, 1896, Mr. K. Keilhack contributes an account of Dr. Th. Thoroddsen's journey in the north-east of Iceland in the summer of 1895. The district explored lies to the north and east of the north-eastern part of Dr Grossmann's route, as shown on the map of Iceland in vol. iii. of the *Journal*, opposite p. 356, and embraces the three peninsulas of Tjörnes, Melrákka Slétta, and Lánganes. The principal result of the journey was the ascertainment of the fact that the extensive area of recent volcanic activity which separates the western and eastern basalts of Iceland, between the Vatnajökull and the Myvatn, extends northwards to the Arctic ocean, the only remnant of the basalt being a mass in the peninsula of Tjörnes inclined to the north-west. The whole region is a vast area of depression, which is bounded on the west by a fault with a considerable downthrow. The basalt has sunk, and at the numerous fissures running parallel to the marginal fault enormous quantities of breccias, tuffs, and lava have been thrown out. This volcanic activity is pre- as well as post-glacial, but there is an important difference in the character of the lavas—those showing distinct traces of having been traversed by inland ice being composed of light dolerites, while those of post-glacial date are formed of dark-coloured and more or less dense basalts. A very important discovery is the fact that the tuff formation, composed of tuffs, ashes, and breccias, partly converted into palagonite, is of various age. Part of it is overlaid by pre-glacial lava-streams, while another part is of later age. The account of this journey in *Petermanns Mitteilungen* is accompanied by a map, coloured so as to distinguish basalt, tuff, pre-glacial and post-glacial lava, pliocene deposits, diluvium and alluvium, and drift sand.

Germans in Hungary.—P. Langhans has contributed to the December number of *Petermanns Mitteilungen*, 1896, a map showing, by means of six colours distinguishing different percental proportions, the distribution of German-speaking people in the lands of the Hungarian crown and the adjacent parts of the Austrian crown lands, according to the census of 1890, Stieler's map on the scale of 1 : 1,500,000 forming the topographical basis. In an explanatory article, he states that the special basis for his map was prepared by inserting the results of the language enumerations of 1890 on the special map of the Austro-Hungarian monarchy on the scale of 1 : 75,000. He adds that, except in one case, he has, in spite of various weighty counter-considerations, adhered to the official figures. The one exception is Budapest, where, he states, the official desire to arrive at a preponderance of Magyars in the capital has undoubtedly led to a depreciation of the German element. This city has accordingly been assigned to the percentage next above that which the official figures warrant. In general, in Galicia and Bukovina, the communes and estates (*Gutsgebiete*) have been taken as the basis of colouring for the sale of correspondence with Hungary. Villages within such areas have been taken into account separately only where a comparison of the numbers made it certain that otherwise the presence of German colonies would not have been shown on the map. This map also makes the attempt, for the first time, to distinguish German-speaking Jews, where found dwelling together in considerable numbers. Where the number of German-speaking Jews in a commune

exceeds in number the Germans by race, the corresponding colour is dotted; otherwise it is left plain.

Germany—New Geographical Society.—The January number of *Petermanns Mitteilungen* announces that, after an interval of twelve years, an addition has been made to the number of German geographical societies, through the foundation at Giessen, at the beginning of December, 1896, of a society for geography and ethnology. It is due to the efforts of Prof. W. Sievers, and already numbers 260 members.

Explorations in Cerigo and Cerigotto.—Dr. Richard Leonhard, of Breslau, has recently spent some weeks in the geographical and geological exploration of the Ionian islands, Cerigo and Cerigotto. Since the days of British administration these remote islands have become more and more out of the world, and Dr. Leonhard's observations are accordingly the more valuable. A large number of determinations of position, height above the sea, etc., furnish useful additions to the Admiralty charts, now fifty years old.

ASIA.

Sir George Robertson on Kafiristan.—The full account of Sir George Robertson's visit to Kafiristan, a preliminary report of which was read to the Royal Geographical Society in June, 1894, and published in the *Geographical Journal*, vol. iv. pp. 193–218, appears as a handsome volume with illustrations by Mr. McCormick.* The book consists of a detailed narrative of the author's travels and residence amongst the Kafirs, interspersed with chapters on the people and their ways. In addition to the fuller light he throws on the character of the people by the description of his daily life amongst them, the book deals with several subjects which considerations of space made it impossible to treat in the paper. The domestic life of the Kafirs is most sympathetically treated, with keen appreciation of the peculiarly difficult character of the people, in which good and bad qualities seem to be blended in an unusually complex manner. Their ceremonial dances and feasts are well described, and the funeral customs are dealt with in detail. The erection of effigies of all people of importance within a year after their death is one of the most interesting of these. The houses and their contents are carefully described, and a good deal of information is given as to the temples and shrines of the gods. The domestic life, including the position of women and slaves, exhibits many curious traits recalling the customs of primitive tribes in widely remote regions. This part of the book furnishes a vast amount of new material for the anthropologist, the more valuable on account of the medical training of the author; but we miss an account of the language of the Bashgul Kafirs, with which he had made himself familiar. The narrative of the visit to the remote Presun valley is of the greatest interest, and every reader must regret that it had to be cut short, as the glimpse given of it seemed to promise far more of novelty and interest than could be found in the valleys easily accessible from Chitral. It seems unlikely now that an opportunity will ever occur for an educated European to study the unaltered people of that remarkable valley where so many memorials of primitive culture have survived unchanged by the surrounding Islamized people. The value of Sir George Robertson's book to students is seriously lessened by the want of an index.

The Andaman and Nicobar Islands.—We have received from Major R. C. Temple, Chief Commissioner for the Andaman and Nicobar islands, reports of

* 'The Kafirs of the Hindu-Kush.' By Sir George Scott Robertson, K.C.S.I. London: Lawrence & Bullen, Ltd. 1896.

various cruises made by him in 1894–95 round these groups, during which much attention was given by the officials who accompanied him to the question of the utilization of the forests of the islands, and to an examination of the anchorages and harbours of their coasts. The latter investigations were carried out by Commander Simpson and Lieut. Mitchell, whose charts of the channels and harbours examined accompany the reports. The narrow channels (Homfray and Middle straits) which separate North and South Andaman respectively from the small Middle Andaman, debouching on the excellent Kwang-tung harbour on the west coast, proved to be practicable for large launches. Safe channels were found for the entry of Stewart sound (on the east coast of the north island), both from the north and south, and good anchorages were met with in Macpherson's strait (south of the south island), in the Archipelago, the Labyrinth islands, and elsewhere. The official chart of Stewart's sound proved quite useless, being entirely at variance with facts. The reports of the forest officers, Mr. C. G. D. Fordyce and Mr. E. M. Buchanan, show that, as already found both here and elsewhere on the coast of the Bay of Bengal by Dr. Kurz and others, different classes of forest occur in zones which succeed one another from the coast towards the interior. These are: (1) The mangrove belt; (2) the beach and littoral forests, of which the most important tree is the *Mimusops littoralis*, or "bullet-wood;" (3) the deciduous forests, containing large numbers of the "padouk," or *Pterocarpus Indica*; (4) the evergreen forests, occurring chiefly on the higher hills and the moister spots on the lower grounds, and marked especially by the presence of the "gurjan" (a *Dipterocarpus*). The mangroves should give a supply of firewood for a long time to come. The "padouk" is a valuable timber tree, so that its abundance promises well for the prospects of forest-exploitation. It appears to re-establish itself easily in certain places from which it has been cleared; but Mr. Buchanan, who makes a special report on the forest around Stewart sound, parts of which were much damaged by the cyclone of 1893, considers that the new crop in such places is likely to contain a much smaller proportion than the original forest of padouk and other hard woods. Near Stewart sound, as in Burma and in the Andamans generally, the ridges were found to run mainly from north to south, and to be separated by long low valleys occupying a large proportionate area. The commonest rock is sandstone, but, being argillaceous, it forms when decomposed a more or less clayey soil. The country is intersected by creeks, supplying natural waterways for the transport of timber. The examination of the forests gave fresh proofs of the resemblance of the flora to that of Burma. Indications of a recent subsidence of the islands were seen in the shape of trees, both dead and alive, standing in the sea, a few mangrove bushes having established themselves between them and the shore. Portions of old brick and stone walls are also covered at high water at the site of the former convict station on Chatham island, but it is possible that the remains are those of a sea-wall. The Andamanese met with were generally friendly. They are an unsettled people, roaming along the shores in search of fish and turtle. Two of the wild Jarawas of Rutland island were captured in the hopes of establishing friendly intercourse, but, beginning to pine and sicken, were sent back to their home.

The Tsangpo of Tibet.—The October number of the *Calcutta Review* contains a carefully written article by Mr. Graham Sandberg, illustrated by two maps, on "The Great River of Tibet: its course from source to outfall," in the course of which we are furnished with an interesting and striking *résumé* of the existing data regarding the Tsangpo, the only blemish being that Mr. Sandberg does not give his authority in every case, and this in a geographical work is of course, a serious defect. So far, however, as we have been able to test his statements,

they are correct, though we think he might have made mention of Lieut. Wilcox's explorations of the upper Irrawaddy, and some other travellers whose researches go to make up the sum total of our present information regarding the mighty Tsangpo. The sources Mr. Sandberg locates approximately in longitude 82° 10′, and about 20 miles south-east of Lake Má-p'ang, where the native tradition places its origin. Glacier-crowned mountains hem it in on three sides, while towards the east the river gradually forms itself in a large gravelly marsh, fed from the adjacent glaciers, and styled, "The Sands of the Mystic Wheel." It is not necessary here to trace the detailed topography of the stream through its eastern course, but it is noteworthy to observe that the still unexplored section of the river between the furthest point to which it has been explored from the Tibetan side and the highest point up to which exploring parties have ascended it from the plains of Assam is only about 70 miles in length, while the distance as the crow flies from the former point to the British frontier is only 25 miles. The total length of the river Mr. Sandberg estimates at 1308 miles up to its union with the eastern Brahmaputra, while its drainage covers some 112,000 square miles. Its sources lie at the altitude of 14,700 feet above sea-level, and for 782 miles the drop is only about 4½ feet to the mile, but after that the fall is very rapid till it emerges from the Himalayas and joins the Brahmaputra at a height of 420 feet.

Journey through Syria to Asia Minor.—The expedition under Roman Oberhummer, after passing through Damascus, Homs, Hama, and Aleppo, Northern Syria, and Cilicia, had in November, 1896, reached Cheshme-Keprikei, on the Halys. Thence Dr. H. Zimmerer, a companion of Oberhummer, writes that the volcanic region of the Erjias-dagh and the Hassan-dagh offered an abundance of matters for investigation in its thousands of tuff cones and its ravines with mysterious artificial caves, and adds that boundless hospitality was experienced in the Greek villages of Tatlarin, Nevshehir, Irgib, and Injesu, in the luxuriant wine-country reaching to Kaisarieh, in the course of the numerous excursions made with a view to the mapping of this unknown corner of Asia Minor. Kiepert's commission to make a topographical survey of the Kizil Irmak between Kessekkepri and Cheshmekepri was also successfully accomplished, though with no little labour and trouble, the route leading through a long narrow defile, but luckily at a time of extreme low water. The travellers next intended to proceed to the great salt lake of Tuz-gel, to make a breach in Kiepert's "*terra incognita*;" and then, following Ramsay's advice, to return to the Halys to seek for the sites of Parnassos and Nyssa. —*Petermanns Mitteilungen*, December, 1896.

The Russian Fur-Seal Islands.—A very valuable report on the Russian seal islands, by Mr. Leonhard Stejneger, of the United States National Museum, has recently been issued by the U.S. Commission of Fish and Fisheries, a copy of which has been presented to the Library. The report is divided into five sections, as follows: I. Introduction; II. The Russian Seal Islands, including the Commander Islands, Robben Island, etc.: III Seal Life on Commander Islands; IV. The Russian Sealing Industry; V. Conclusions. Until 1867 all the resorts of the northern fur-seal north of California belonged to the Russian Empire. These resorts were in all instances uninhabited islands. They were discovered by the Russian fur-hunters in the middle and latter part of the last century, and included the Commander group, certain small islands in the Okhotsk sea, certain small islands in the Kuril chain, and the Pribylof group. There only remain in the possession of the Russian Crown at the present date the Commander islands and the islands in the Okhotsk sea. The Commander islands, which were visited by the author on two separate occasions, in 1882–83 and in 1895, comprise two main islands, Bering and Copper, situated off the east coast of Kamchatka, between

54° 33′ and 55° 22′ N. lat., and 165° 40′ and 168° 9′ E. long., approximately 97 miles from Cape Kamchatka. Geographically, they are the westernmost group of the Aleutian chain, although politically they form a separate administrative district of the so-called coast province. The group was discovered on November 4, 1741 (Old Style), by Commander Vitus Bering, on his return voyage after having discovered the mainland of America. The climate of the Commander islands is not particularly severe, but the excessive moisture and the low summer temperature make it disagreeable, though not unhealthy. During the author's visit in 1882, he established and maintained a meteorological station at Nikolski, Bering island. The maximum temperature in Bering island was found to be 63° Fahr., while the minimum was seldom below zero during the four years of observation. The difference between the summer and winter extremes is less on Bering island than on St. Paul island, Pribylof group. As might be expected from their situation, the islands are chiefly palæarctic in their bio-geographical relations, with a fair sprinkling of circumpolar, American, and North Pacific forms, the marine fauna and flora partaking more particularly of this latter character. The flora very generally resembles that of the treeless regions of northern Europe. Certain plants found indicate the close relationships to the flora of Kamchatka and the other Aleutian islands. The islands are completely destitute of trees. In 1895, the Commander islands contained a mixed population of about 670 of both sexes. Bering island, the north-western island of the Commander group, is situated between (approximately) 55° 22′ and 54° 42′ N. lat., and 165° 40′ and 166° 41′ E. long. Its greatest length from north-west to south-east is a little less than 50 miles, with an average breadth of about 10 miles. The southern two-thirds of Bering island are mountains, with peaks rising to about 2200 feet. The most conspicuous mountain of the southern mass, and the highest on the island, has been named by the author Mount Steller. The northern third of the island has an entirely different aspect from the remainder. It is described as being low, the highest elevation being slightly more than 600 feet. The land rises in a series of terraces till it forms either large plateaus with a somewhat undulating surface, or the tops of regular, flat-topped table mountains. There are two groups of these table mountains. The highest altitude of the former group was found to be 577 feet; of the latter, 617 feet. The two main plateaus are the *Northern plateau* and *Tonkoi plateau*. A number of lakes are stated to exist on the island, among which may be mentioned the large Saranna lake, covering an area of about 20 square miles. There are two seal rookeries on Bering island. The great north rookery is situated on the northernmost prolongation of the island (Severni Mys, also called Cape Yushin), about 11 miles from the main village, Nikolski, and about 10 miles from the north-west cape, Zapadni Mys. The south rookery is situated on the west coast of the island, halfway between the north-west cape and Cape Manati, nearly 16 miles from Nikolski. Copper island lies between 54° 53′ 30″ and 54° 33′ 30″ N. lat., and 167° 28′ 30″ and 168° 9′ E. long. (approximately). It is described as very mountainous, long, and narrow, the length being nearly 30 miles, the average width about 2 miles. It is distant from Bering island about 29 miles. From the north-western extremity to the south-east end, the island consists of a backbone of peaked mountains, from 1000 to 2000 feet high, and connected by ridges varying from 500 to 900 feet high. There are two distinct groups of seal rookeries on the west side of Copper island, named Karabelni and Glinka, located in its south-eastern half, about 4½ miles apart. Robben island is situated in the Okhotsk sea, 11 miles south-west from Cape Patience, on the eastern shore of Sakhalin island. This island was not visited by the author. The Robben island seals appear to be a separate and

distinct herd from those on the Commander islands. St. Iona island and Shautar islands are also noticed in the report. The author speaks very unfavourably of the present condition of things as practised by the sealers, and urges the necessity of establishing certain protective measures, which, it is thought, would, in a few years, greatly benefit the fur trade. The report contains some important maps and a number of illustrations.

AFRICA.

Miss Kingsley on West Africa.*—The racy but too brief note of her journey in West Africa in 1895 which Miss Kingsley communicated to the *Journal* (vol. vii., 1896, p. 95) must have created a demand for some more complete description, which the handsome volume now before us fully supplies. Miss Kingsley carried a merry heart with her, and the success of this good medicine is shown by the way in which she escaped serious consequences in the course of extended travels through the most unhealthy parts of Africa. We note with regret that she does not publish her promised map. Apart from the considerable anthropological value of the chapters on fetish, and the importance of her collections of fish, reptiles, and insects, Miss Kingsley has enriched the literature of travel by an extremely entertaining book, which will convey vivid impressions of that strange world to many who would decline more formal instruction. The descriptions of mangrove swamps and their gradual transformation into dry land, and the word-pictures of the tropical forests in which the gorilla wanders, are worthy of special praise. A clever parallel is drawn between the tangled primeval forest, so bewildering on first acquaintance, but afterwards so full of interest and beauty, and the cloudy mind of the native African, which baffles many Europeans to make its acquaintance. There are some slips in orthography which might have been corrected, e.g. *M'Ubanji*, *Tschwi* (for *Chi*), *Okijun*, and *Karkola*, for which in a footnote the alternative form *Kakola* is given, the *r* being silent, and therefore, according to the R.G.S. rules, superfluous. The terms "left and right" bank of the Congo (pp. 359 and 361) are misapplied, the term, used geographically, always referring to the right and left hands of a person looking in the direction towards which the river flows. Miss Kingsley states that she is not a geographer, but she proves herself possessed of the geographical instinct in many particulars. She gives a curious account of such instinct in a Fan chief encountered at the Ogowe rapids. "He took a piece of plantain leaf, and tore it up into five different-sized bits. These he laid along the edge of our canoe at different intervals of space, while he told M'bo things, mainly scandalous, about the characters of the villages these bits of leaf represented, save, of course, about bit A, which represented his own. The interval between the bits was proportional to the interval between the villages, and the size of the bits was proportional to the size of the village." Miss Kingsley lays stress on the importance of some knowledge of native languages in travellers who attempt to find the native names of places. She states that she found four villages and two rivers named by previous travellers with various native forms of "I don't know."

Two Historical Books on South-East Africa.—Dr. Theal's recent volume† is intended as a supplement to his well-known history of South Africa, rendered necessary, he thinks, by the extended use of the term "South Africa," to include

* 'Travels in West Africa: Congo Français, Corisco, and Cameroons.' By Mary H. Kingsley. London: Macmillan & Co. 1897.

† 'The Portuguese in South Africa.' By George M'Call Theal, LL.D. With maps. London: Unwin. 1896.

the whole country up to the Zambesi. The main attention is therefore devoted to the Portuguese possessions south of that river, although the comprehensive sketch of the various early voyages to this part of the world necessarily includes details respecting Mozambique and other northern ports. This limitation is perhaps to be regretted, as, with a slight extension of scope, the book would have served as a summary of the Portuguese dealings with East Africa in general. It is written in Dr. Theal's usual lucid style, and includes an account of the native races of South Africa during the sixteenth century, when the distribution of the tribes differed much from that seen at the present day. Some interesting details on this subject are derived from the accounts of overland journeys made by shipwrecked crews on the south-east coast in the middle of the sixteenth century. At an earlier date, the Portuguese relations with the so-called empire of Monomotapa, including the disastrous expedition of Francisco Barreto, are fully dealt with. Dr. Theal shows that the name Monomotapa was the hereditary title of the chief of the Makalanga tribe, and probably meant either "chief of the mountain" or "chief of the mines." From the beginning of the seventeenth century onwards, the prosperity of the colonies rapidly declined, and Sofala soon lost its importance as a place of trade. In East Africa, no less than in the East, the rivalry of the Dutch and English * had been felt, and Mozambique had been partially destroyed by the former in 1609. A revival of activity dates only from the middle of the present century. Dr. Theal looks upon the prospects of Portuguese East Africa with more hope than many writers, considering that they are now brighter than at any time since the fort of Sofola was built by Pedro da Nhaya, in 1505. The second book † we have to notice is concerned with the gold-mining region in Mashonaland, and traces its history, in the light of Mr. Bent's explorations, and of the author's own investigations into the Vatican and other records, from the times of the Phœnicians, through those of the Arabs and Portuguese down to the year 1830. Monomotapa is spoken of throughout as the name of the *country*, but this is perhaps merely a concession to long-established usage. No attempt is made to show that the empire was of any great importance, judged by European standards; but Mr. Wilmot appears to attribute to the Portuguese a more intimate acquaintance with the interior than is allowed by Dr. Theal. The missionary records quoted show that the Jesuits, at least, were well acquainted with Zimbabwe, where, after meeting with some success in his labours, Father Gonzolo Silveira was martyred in 1561. The book contains the reproduction of an Italian map published in 1623, on which the two great central lakes appear in exactly the form in which they were subsequently given in Dapper's map. Mr. Wilmot notes that Monomotapa is well filled with names, but the fact that Abyssinian names appear on its very borders shows that no reliance can be placed on the positions assigned to places in the interior.

Mr. Weatherley's Survey of Lake Bangweolo.—Sir Harry Johnston and Mr. Alfred Sharpe have communicated the substance of letters received from Mr. Poulett Weatherley, announcing the completion of a thorough survey of Lake Bangweolo, and describing a visit to the scene of Livingstone's death. Full details will no doubt be received on the traveller's return to England. The general result seems to be to show considerable divergences in the shape of the lake from that

* An interesting point in connection with the early English voyages alluded to by Dr. Theal, is the proclamation of British sovereignty at Table bay by English officers in 1860, a proceeding which, however, led to no result.

† 'Monomotapa' (Rhodesia). By the Hon. A. Wilmot. With Preface by H. Rider Haggard. Maps and Plates. London: Unwin. 1896.

assigned to it in Giraud's map. Mr. Weatherley likens it to an elongated letter O. Its swampy margins are almost entirely deserted, having little to attract human beings. The country to the south does not appear to be such a continuous marsh as had been supposed, for, although there is plenty of swamp, there are also great extents of beautiful wooded country. Game has been mostly killed off by the rinderpest, but elephants are found in the swamps. Mr. Weatherley describes the scene of Livingstone's death as most impressive, the rugged old mpundu tree,* beneath which the great explorer's heart was buried, forming a most solemn and appropriate monument, standing as it does in the midst of solitude, for the native village has been moved 10 miles to the west. The tree is, however, fast becoming a mere shell, and Mr. Weatherley strongly urges that something should be done to mark the spot in a lasting manner, lest it should soon be hopelessly lost sight of.

M. Versepuy's Journey across Africa.—An account of the expedition of the late M. Versepuy was given by Baron de Romans, the second in command, before the Paris Geographical Society in December last, and appears in the *Comptes Rendus* of the Society (1896, Nos. 17–19). The early stages of the journey need not be touched upon, as they led over well-known ground in Masailand and Uganda From Mengo the expedition proceeded to Lake Albert Edward, which, according to the French traveller, is separated from the smaller lake Ruheru (Rusango) by a distance of 25 miles, the stream which connects the two lakes being small and unimportant. Rusango is said to be over 600 feet higher than Lake Albert Edward, and to form a vast marsh, although, according to Captain Lugard, there is no swamp around it except at the north-east end. The Semliki valley was found to be peopled by fugitives from Unyoro. Just within the limits of the forest region, a small Arab outpost flying the flag of the Congo State was reached. The route led from the upper Semliki to the Ibina, a southern tributary of the Ituri, to which its course was followed. The forest was high, and a path had to be cut through it, much difficulty being experienced from want of supplies. Elephants and leopards abounded. Crossing the Ituri, the expedition reached the military post of Kilongalonga, belonging to the Congo State, where three Belgian officers were met with. Reaching the still more important post of Arakubi, the travellers obtained canoes and descended the Ituri and Aruwimi to the Congo. They describe the great forest as continuous from the Semliki valley to Leopoldville.

Captain Ramsay on Ujiji and Tanganyika.—An expedition under Captain Ramsay, well known for his surveys in various parts of German Africa, has reached Lake Tanganyika, and there is every prospect that European influence, which received a serious check in these regions at the time of the Arab revolt in German East Africa, will soon be re-established. The town of Ujiji does not, according to Captain Ramsay (*Deutsches Kolonialblatt*, December 15, 1896), present the ruinous appearance which had been reported. It still extends over a large area, and contains at least as many inhabitants as Tabora. The fall in the level of Tanganyika has left a wide sandy plain between it and the water, but for the last two years the sinking of the water has ceased.† The Arab traders will welcome the establishment of a German station at Ujiji, as likely to cause a revival of trade. At present

* Mr. Weatherley has sent home some of the leaves of this tree as a memento.

† Mr. A. Whyte, an account of whose journey in the mountains west of Nyasa has been lately appearing in the *British Central Africa Gazette*, says that Lake Nyasa rose higher in 1896 than it had been known to do for fifteen years, so that it would seem that a period of general rise in the lakes of Central Africa may have lately set in. We hope to notice Mr. Whyte's journey further on receipt of the final instalment of his narrative.

it is at a low ebb. The slave-trade has fortunately entirely ceased, but that in ivory has also suffered a diminution, owing to the Belgian activity on the west side of the lake. The chief ivory districts are Manyuema and Uvira. Salt, obtained from Uvinza, is an important article of trade, the whole of the country west, east, and north of the lake being supplied from this source. Captain Ramsay made a journey to the north of the lake, being well received everywhere. In Kafagga, east of the Congo State boundary, an important daily market is held. He ascended the course of the Lusizi (Rusizi) during a three days' march, and found it a copious stream, navigable for canoes, and receiving many tributaries from the mountains of Urundi, and bringing to Tanganyika at least as much water as the Malagarasi. Its valley is a wide almost treeless plain, and the whole region abounds in elephants. Urundi made a great impression on the traveller by its fertility, and its banana plantations recalled those of Konde, at the north end of Nyasa.

Steam Transport in German East Africa.—The success which has attended the placing of the steamer *Hermann von Wissmann* on Lake Nyasa has led to the formation of a similar project with reference to Lake Tanganyika. A committee has been formed under the presidency of the Duke of Mecklenburg-Schwerin, and at a meeting held on November 4 last it was decided that the project should be proceeded with. Lieut. Schloifer, who in 1892–93 visited the Victoria Nyanza in furtherance of the aims of the German Anti-Slavery Committee, has been chosen to carry out the work, and hopes to combine with it scientific investigations into the geology, geography, and anthropology of the regions traversed. The route *viâ* Lake Nyasa has been chosen for the transport of the sections, but it has not yet been decided whether the material shall be steel or aluminium. The steamer is to be named *Hedwig von Wissmann*. It is proposed, also, to transport a steamer in sections, *viâ* Lakes Nyasa and Tanganyika, for the Victoria Nyanza (*Aus Allen Weltteilen*, pt. i., 1896; *Petermanns Mitteilungen*, No. 11). As regards the navigation of Lake Nyasa, the reported discovery of extensive coalfields between the Kivira and Songwe rivers, by Herr Bornhardt, seems likely to be of importance (*Geographische Zeitschrift*, 1896, No. 12). The construction of the railway to Lake Tanganyika does not appear to have been definitely decided on. At a discussion before the German Colonial Society in Berlin in November last, Major von Wissmann urged the necessity of such a railway, but deprecated undue haste in its construction. The line from Tanga towards the interior has reached Muheza, at the end of the first stage, and there is a regular service once a week in each direction; but want of funds prevents its extension even to Korogwe on the Ruvu, and the future of the undertaking must depend on the result of the larger scheme (*Deutsches Kolonialblatt*, 1896, p. 374).

New Project for a French Niger Railway.—As early as 1888 a scheme was formed in France for the construction of a railway to the upper Niger from some point on the coast of French Guinea, the distance hence to the river being no greater than that from Kayes, the starting-point of the Senegal railway. The idea was, however, dropped for a time, owing to the fact that the Anglo-French delimitation gave to Great Britain a portion of the territory through which it had been proposed to carry the line. A survey has since (1895–96) been carried out by Captain Salesse by a slightly more northerly route, starting from Konakry instead of Benty, and an account of the main results appears in the December number of the *Bulletin du Comité de l'Afrique Française* (p. 373, with map). The survey was based on theodolite observations, which supplied the material for a map on the scale of 1 : 50,000 for the first half of the distance, during which the country consists mainly of sandstone or of plateaux covered with laterite. There are some difficult places, the worst of all being at the passage of the ridge of Kolossoghea, between

the basins of the Kaba and Mongo rivers. The route debouched on the Niger at Faranna, which is, however, situated above the last rapids. Captain Salesse, therefore, recommends Somoreia, lower down the Niger, as the terminus, the second half of the route diverging, in this case, to the north of that surveyed, and probably leading through a less difficult country. This line, if constructed, would prove a serious rival of the British Sierra Leone railway.

Positions fixed by M. Foureau in the Northern Sahara.—A list of positions fixed by M. Foureau during his journey of 1895-96 (*Journal*, vol. vii. p. 663) is given in the *Comptes Rendus* of the Paris Geographical Society (1896, pp. 304, 305). They are based almost entirely on observations of stars, and relate to the eastern part of the Algerian Sahara, between 29° 40′ and 33° 40′ N. lat.

AMERICA.

The Headwaters and Length of the Missouri.—Fresh from his investigations at the sources of the Mississippi, the Hon. J. V. Brower started, in the summer of 1895, to discover the headwaters of the Missouri. Near Three Forks the Gallatin joins the united waters of the Madison and Jefferson, thereafter known as the Missouri. The Jefferson fork, considered to be the main stream, is known as Beaver Head creek, then as Red Rock creek higher up. Driving from Lima, Mont., up this Red Rock creek, Mr. Brower soon reached the expansions of the stream known as the lower and upper Red Rock lakes, and started exploring the rivulets that feed the latter. The survey maps show the Red Rock creek above the upper lake, formed by the junction of two streams, marked the North and South forks. Mr. Brower says, "The two forks were found to flow out from Culver's cañon . . . , and, after a meandering circuit of about 3 miles, they come together again . . . Discovering that the principal stream issued out from it (Culver's canon) in four channels, cast asunder by an impetuous current plunging over a débrital mass to a quaternion division, a thorough exploration of the locality was deemed advisable and necessary." The gorge is of a rugged character, and at one point "is located the site of a former cataract, now a rapid, where the mountain range has been practically severed in twain by the eroding action of increasing and long-continued flowage." It would appear the place well deserves the graphic name it bears — Hell Roaring cañon, which Mr. Brower wishes to replace by Culver's cañon, after the settler who accompanied him to the source of the Missouri. This source is not far from the end of the gorge, in a "hole in the summit of the Rocky mountains," at an elevation of about 8000 feet. From this hole to Three Forks, Mr. Brower estimates the length of the river at 398 miles; from Three Forks to its confluence with the Mississippi is 2547 miles, and from the latter point to the southwest passage at the delta is 1276 miles. The total length of the Missouri-Mississippi is thus 4221 miles. Mr. Brower gives this and much miscellaneous information, which would have been the better for more careful editing, in his book—'The Missouri River and its Utmost Source: Curtailed Narration of Geologic, Primitive, and Geographic Distinctions descriptive of the Evolution and Discovery of the River and its Headwaters' (St. Paul, Minnesota, 1896).

AUSTRALASIA.

New Zealand Alps.—This volume* is a record of the explorations and adventures of the surveyors employed by the Government of New Zealand, in the years

* 'Pioneer Work in the Alps of New Zealand: a Record of the First Exploration of the Chief Glaciers and Ranges of the Southern Alps.' By Arthur P. Harper, B.A. With maps and illustrations. London: Fisher Unwin. 1896.

1893–95, to investigate and map the western valleys and glaciers of the central portion of the Southern Alps. Mr. Harper gives a very straightforward and lively description of the difficulties and hardships encountered by Mr. Douglas and himself in their task. He leads his readers through trackless gorges, where the rate of progress was sometimes little more than a mile a day, to the icefalls which pour down from a crest of 8000 feet to within 700 feet of the sea-level. In New Zealand, as elsewhere, it is found that, the glaciers that descend lowest are those which combine steep beds with considerable *névé* basins, and therefore move with the greatest velocity. Mr. Harper's measurements indicate that the respective falls of the Tasman and Franz Josef glaciers are 187·7 feet, and 1064 feet per mile, while the maximum rate of motion of the latter stream is more than fourteen times as great as that of the former. There are, on the western slope, some very remarkable specimens of *glaciers remaniés*—glaciers, that is, which are reformed after falling in avalanches over a cliff. The forests, tree-ferns, and scrub of this side of the range are a great addition to the scenery, but, until tracks have been blazed, a terrible hindrance to the explorer, whose difficulties have further been increased by the destruction of the native wingless birds, which served him as supplies, by the cats and weasels imported into the island. Mr. Harper furnishes valuable facts and some arguments as to the geological structure of the range, the present movements and past extension of the ice, the fauna, and flora. He is observant of nature in many forms, and his pages are full of varied interest. The region he describes has hitherto been approachable only by a circuitous road, liable to frequent interruption. Mr. Harper points out that the construction of a summer horse-track over the direct pass from the Hermitage to the west coast, first recognized and crossed by Mr. Fitz Gerald in 1895, though delayed by want of funds, must before long be carried out. When this has been done, other tracks will no doubt be blazed, and "visitors to the glaciers" will become, at least, as common in New Zealand as they were in Savoy a hundred years ago. Recent publications have raised a question as to what is the true and most appropriate meaning of the expression "Southern Alps," which climbers and colonists have used in very various senses. A full exposition of the matter will be found in the February number (135) of the *Alpine Journal*. Mr. Fitz Gerald has explained that he limits the term to the central portion, or Mount Cook group; the Surveyor-General of New Zealand (Reports 1895–96), and several New Zealand climbers, appear to treat the unbroken crest between Haast's pass and Whitcombe's pass as the "Southern Alps proper," but write generally of the Southern Alps with some indecision as to their limits. Mr. Douglas Freshfield suggests that the course most likely to obtain general acceptance is to include in the "Southern Alps" all the glacier-clad ranges south of Harper's pass. This would be in accordance with the indications of Captain Cook, who on his map brings the Southern Alps up to the latitude of Banks's peninsula. Of course, if the term is to be understood in this sense, recent claims to "the first crossing of the Southern Alps" must fall to the ground. The first complete crossing to the western sea over the snowy ridge 100 miles long, between Haast's and Whitcombe's passes, was that made by the Messrs. Pringle and Blythe, at the head of the Godley glacier, in 1892; and the first complete crossing, from the Hermitage over the Mount Cook group to the sea, by Mr. Fitz Gerald and Zurbriggen, of Macugnaga (who is an Italian, and not a Swiss guide), in 1895. On the flanks of the range the glacier summits are arranged, not in lines, but in groups separated from one another by grassy gaps, which were most of them crossed many years since, and over one of which (Arthur's pass) a coach has long run, and a railway is in construction. A good map, closely resembling that already issued with Mr. Fitz Gerald's book, and based mainly on the same sources—

that is, on the separate maps which have accompanied recent New Zealand Government Survey Reports, and as to the west coast, on Mr. Harper's and Mr. Douglas's own work—renders the narrative intelligible. The illustrations are numerous, but have more topographic than artistic merit.

GENERAL.

Mr. Hogarth's Travels in the Levant.—This little book,* which is illustrated by thirteen beautifully executed plates from photographs or sketches, is one of rare and manifold interest. Its two hundred pages sum up the impressions and observations of numerous journeys in the interests of learning in Asia Minor, Cyprus, and Egypt, spread over the interval between 1887 and the beginning of 1896, and an exceptional combination of qualities in the author makes the result of peculiar value. The scholarly mind is apt to be oppressed with the weight of tradition and dogma; but throughout this work we have scholarly lore and feeling united with genuine independence in the point of view, and to these qualities are added sympathetic insight, catholic with the catholicity of one who has surveyed with human interest the vicissitudes of the ages; in descriptions of scenery, an eye both for broad effects and picturesque or telling detail, and a power of calling up not only the scene but the emotion of the scene, whether arising merely from the natural aspect or the human associations; and everywhere literary skill and taste, including an unusually fine sense of the melody of prose. For geographers, perhaps, the most interesting piece of description is that on pp. 84–89, of "that matchless cornland, the Central Axylon Plain," which "cartographers write . . . a desert," so that, according to Mr. Hogarth, "that term must include an undulating treeless plain which sends up corn breast-high for the scratching of a Homeric plough."

Sir Joseph Banks's Journal.†—Following on the recent publication by Admiral Wharton of Captain Cook's own journal kept during his first voyage, the reprint of Sir Joseph Banks's journal during the same voyage, under the able editorship of Sir Joseph Hooker, comes opportunely to further enrich the literature on the subject, which is now unusually complete. As is stated by Sir J. Hooker in his preface, the great services rendered by Banks, both to natural science in general and to this expedition, have so far been by no means adequately recognized. The journal, now published for the first time in full, was placed by Banks in the hands of Dr. Hawkesworth, when the latter was bringing out his edition of Cook's voyage, and the extensive use made of it may be seen by comparing the present volume with Cook's own journal. In fact, almost the whole of the account as given by Hawkesworth, with the exception of the details relating to navigation, are from the diary of the naturalist, of the extent of whose services Cook himself was deeply sensible. Not only were the results from an ethnological point of view almost entirely due to Banks, but his active co-operation in the general labours of the expedition was no less valuable. In addition to many identifications of plants and animals mentioned by the writer, Sir Joseph Hooker supplies an interesting biographical sketch of his life, while the book also includes a life of Dr. Solander, and notices of the earlier voyagers and naturalists mentioned in the narrative, from other pens. The reprint has been made from a copy of Banks's journal taken in

* 'A Wandering Scholar in the Levant.' By David G. Hogarth. Second edition. London: John Murray. 1896. Size 7¼ × 5¼, pp. 206. Plates.

† 'Journal of the Right Hon. Sir Joseph Banks, Bart., K.B., P.R.S., during Captain Cook's First Voyage.' Edited by Sir Joseph D. Hooker. Portraits and charts. London: Macmillan. 1896.

1833, the original having been unfortunately lost through the dispersion of the Banks collection of papers by sale to autograph-collectors. The distressing history of the manuscript is given in detail in the preface.

Death of S. S. Rogozinski.—The Polish traveller, Rogozinski, well known for his explorations in the Cameroons in the years 1882–84, and for his ascent of Clarence peak, on Fernando Po, in 1890, died in Paris early in December last.

CORRESPONDENCE.

Popocatepetl.

Gresham House, London, E.C., January 30, 1897.

Since my return from Mexico this month, my attention has been drawn to the communications of the Rev. W. A. B. Coolidge, Mr. W. T. Munro, and Prof. Angelo Heilprin, in the *Journals* of September and January last, referring to my paper on "Popocatepetl and the Volcanoes of the Mexico Valley." I am greatly obliged for the references to Mr. Whitehouse's description, which I will take an early opportunity of studying.

I may remark, however, that my paper was intended to deal generally with the transcontinental volcanic belt, and not with Popocatepetl alone. The accounts of the ascents of Ixtaccihuatl, and especially the alleged existence of a crater, will be of peculiar interest to me; though I may point out that even this latter fact is not inconsistent with my view that the mountain itself "does not represent any eruptive vent." The evidence of a transcontinental rift, which I have endeavoured to establish, would be strengthened by the signs of another lateral break into the older porphyritic series, similar to that of Texcotzingo to which I referred (p. 148 of August *Journal*).

Mr. Munro and Prof. Heilprin have slightly misunderstood my remark about the "eternal snows." There is, of course, always plenty of ice and snow to be found at those altitudes, and at certain points they may rarely, if ever, disappear. What I pointed out was that there is no defined limit above which they are perpetual. When I left the state of Puebla in October last (since the date of my paper), the whole eastern side of Popocatepetl was clear of snow almost to the crater-level. This is not uncommonly the case in some seasons, and, I think, fully warrants the statement that there is "no snow-line." On the western or Mexico side, from which the ascent is usually made, the snow always lies heavier and longer, but is similarly subject to much variation.

Prof. Heilprin expresses a doubt as to the "existence in fact" of the east-and-west volcanic fissure. As he does not, however, mention any reasons for the doubt, it is not within the reach of discussion.

O. H. Howarth.

OBITUARY.

Frederick J. Mouat, M.D., LL.D.

Surgeon-Major Frederick Mouat, formerly Inspector-General of Prisons in Bengal, died at his residence at Kensington on January 12 last. He was born in 1816, being the son of Surgeon James Mouat, of the King's Hussars and the 13th Light Dragoons. After studying at University College, London, and at

Paris, he proceeded to Edinburgh University, where he obtained the degree of M.D. in 1839. The best years of his life were spent in India, where he held various Government appointments—including, among others, those of Deputy Inspector-General of the Bengal Army, Inspector-General of Prisons in Bengal, Professor of Chemistry and *Materia Medica*, and Professor of Medicine and Medical Jurisprudence; he was also secretary of the Council of Education, Bengal. In 1857 he undertook an expedition to the then rarely visited Andaman islands, with a view to the selection of a site for a penal settlement, and he described the results of his visit in a paper read before the Royal Geographical Society, and printed in vol. xxxii. of the *Journal* (1862). The full report on the expedition had already appeared in India as the 25th number of the 'Selections from the Records of the Government of India' (1859). One of the results of the expedition was the discovery of the harbour since known as Port Mouat. In 1863 Dr. Mouat published a volume entitled 'Adventures and Researches among the Andaman Islanders.' In a work published in Calcutta some years before, he had described a trip to Réunion, Mauritius, and Ceylon, discussing the question of their eligibility as sanitaria for Indian invalids. His other works and papers deal chiefly with medical subjects and questions relating to prisons. He was joint author of a 'History of the Statistical Society of London,' published in 1885, and was President of that Society in 1890–92. He became a Fellow of our Society in 1861. He was twice married, in 1842 and again in 1889.

Sir J. B. Thurston, K.C.M.G.

Sir John Bates Thurston, High Commissioner in the Western Pacific and Governor of Fiji, whose death was announced early in February, had been a member of our Society for the last twelve years. His connection with Fiji dated from 1866, when, at the age of thirty, after serving for some years in the mercantile service, he entered the British consulate in those islands. In 1869 he became Acting Consul, and before the annexation of the group by Great Britain in 1874, the chief control of the affairs of the islands had fallen into his hands. Mr. Thurston served with ability and success under Sir Arthur Gordon (now Lord Stanmore), the first High Commissioner for the Western Pacific, and was himself promoted to that post in 1887, having in 1885 acted as British Commissioner in the negotiations with Germany concerning the affairs of the Pacific islands. In 1883 he had married a daughter of Mr. John Berry, of New South Wales.

Admiral Sir Alexander Milne, G.C.B.

We regret to have to record the death of Admiral of the Fleet Sir Alexander Milne, G.C.B., who had been a Fellow of our Society since 1866, and who succumbed to pneumonia resulting from a chill at the end of December last, at the age of ninety years. The second son of Admiral Sir David Milne, who distinguished himself in many actions with the French at the beginning of the century, our late associate entered the navy at an early age, and, after serving on various foreign stations, became commander in 1830. From 1836 to 1841 he was engaged partly in the repression of the slave-trade in the West Indies, and partly in the protection of the fisheries off Newfoundland and Labrador, becoming captain in 1839. After serving for some years in home waters, and after holding the post of Junior Lord of the Admiralty from 1847 to 1859, he became Commander-in-Chief on the North-American station in 1860, and helped to improve the relations between this country and the United States by the tact which he displayed during a visit to New York

with his ships in 1863. Between 1865 and 1876 he was twice Senior Naval Lord of the Admiralty, with an interval of service as Commander-in-Chief of the Mediterranean and Channel Squadrons. After the close of his professional career, he did good work as a member of various committees, especially with reference to questions of colonial defence, and in 1890–91 took an active interest in the Naval Exhibition. Between 1876 and 1881 he had served as Vice-President and Member of Council of our Society.

John Lowe Nicholl.

The death has been announced of Mr. John Lowe Nicholl, one of the pioneers of British enterprise in Nyasaland, where he had spent more than fifteen years. Originally a member of the Blantyre Mission, he subsequently served eight years with the African Lakes Company, and whilst so engaged convoyed the loads of the London Missionary Society's steamer *Good News* to Lake Tanganyika (1884–87). He fought all through the Arab war in North Nyasaland (1887–89), frequently saving the situation by bringing up native levies. In 1889–90 he accompanied Sir Harry Johnston on his journey between Lakes Nyasa and Tanganyika, and in the latter year founded the important station of Abercorn, at the south end of Tanganyika, for the African Lakes Company. In 1892 he entered the service of the British Central Africa Protectorate, and was for some years Collector for the South Nyasa district, and since 1894 Vice-Consul for South Nyasa. Although of small stature and apparently of weak physical organization, he was a man of remarkable courage. He was possessed of considerable erudition, and was universally esteemed by those with whom he came in contact. Among the natives he was a great favourite. His death is much regretted by all the Europeans in British Central Africa. He became a Fellow of our Society in 1891.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1896–1897.

Afternoon Technical Meeting, Tuesday, January 19, 1897.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

THE Paper read was:—

"On Sand Dunes." By Vaughan Cornish.

Fifth Ordinary Meeting, January 25, 1897.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Farsett G. Arbouin; C. A. Montague Barlow, Barrister-at-Law; T. J. Barnardo, F.R.C.S.E.; Carsten E. Borchgrevink; Samuel Baxter Boulton, J.P.; William Stewart Ranulf Brock; George Archibald Charles Brown; Edward Chaplin; George William Forrest, B.A. (Cantab.); Thomas Edward Hardy; Albert Frederick Alonzo Howe, L.D.S., R.C.S. Eng.; Francis Wingfield King; Robert Trefusis Mallet, C.E., M. Inst. C.E.; Walter John Mathams; Newman M. Ogle; John Paton; Robert Watson Purves; John Bamford Slack, B.A.; Henry George Slade; Sir Charles Strickland, Bart.*

The Paper read was:—

"An Expedition across Spitzbergen." By Sir W. Martin Conway.

Sixth Ordinary Meeting, February 8, 1897.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Thomas Batson; Charles William Bell; John Browne; Frederick Garnett Clarke; W. Luther Croll; Edward Read Davies; D. N. Dhar; Edward Price Blackwood Hallowes; I. Hardy; Roger Lloyd Kennion; James Patrick Leslie; Henry Moncrieff Paul; Captain Ricardo D. Petrie, R.E.; George Edward Price; Edwin Benjamin Raymond; Thomas Slingsby Tanner; Augustus George Wildy; Glenne Barrington Leard Williams.*

The Paper read was:—

"An Expedition across the North Polar Area." By Dr. Fridtjof Nansen.

Afternoon Technical Meeting, Thursday, February 18, *at* 5 *p.m.*—General R. STRACHEY, R.E., C.S.I., etc., Vice-President, in the chair.

The Paper read was:—

"The Teaching of Geography in Relation to History." By A. W. Andrews.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce, Commercial.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
J. = Journal.
M. = Mitteilungen.
Mag. = Magazine.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue, Revista.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

EUROPE.

Alps. *Annuaire Club Alpin Français* **22**, 1895 (1896): 465–484. **Girod.**

Les anciens glaciers et les alpinistes préhistoriques. Par M. le Dr. Paul Girod.

On the remains of primitive man at considerable elevations in the Alps.

Alps. **Lenthéric.**

L'Homme devant les Alpes. Par Charles Lenthéric. Paris: E. Plon, Nourrit et Cie., 1896. Size 9 × 6, pp. 12 and 480. *Maps.*

This book deals with prehistoric man, the migrations of early peoples, the subdivisions of the Alps, their origin, and the whole history of trans-Alpine paths, roads, and railways. The map given as a frontispiece is traced from a pre-Victorian original, showing the great range across Africa in 6° N., and other curious relics of the past.

Alps. *Deutsche Rundschau G.* **19** (1896–97): 101–109, 155–159. **Mader.**

Aus den Ligurischen Alpen. Von Fritz Mader. *With Illustrations.*

Alps. *Z. Deutsch. u. Oesterr. Alpenvereins* **27** (1896): 62–88. **Ratzel.**

Die Alpen inmitten der geschichtlichen Bewegungen. Von Prof. Dr. Friedr. Ratzel.

Austria—Bohemia. **Ruvarac and Penck.**

Die Abfluss- und Niederschlagsverhältnisse von Böhmen von Dr. Vaso Ruvarac nebst Untersuchungen über Verdunstung und Abfluss von grösseren Landflächen von Prof. Dr. Albrecht Penck—Geographische Abhandlungen. Herausgegeben von Prof. Dr. Albrecht Penck in Wien. Band V. Heft 5. Wien: E. Hölzel, 1896. Size 11 × 7½, pp. [80]. *Maps and Plates. Presented by Prof. Dr. A. Penck.*

Dr. Ruvarac's paper is illustrated by a rainfall map of Bohemia. Both papers deal with the question of the relation between rainfall and evaporation.

Austria—Salzkammergut. **Müllner.**

Die Seen des Salzkammergutes und die österreichische Traun. Erläuterungen zur ersten Lieferung des österreichischen Seenatlasses. Von Dr. Johann Müllner.—Geographische Abhandlungen. Herausgegeben von Prof. Dr. Albrecht Penck in Wien. Band VI. Heft 1. Wien: E. Hölzel, 1896. Size 11 × 7½, pp. 116. *Plates. Presented by Prof. Dr. A. Penck.*

France—Arcachon. **Duffart.**

Le Bassin d'Arcachon.—Géographie rétrospective du Bassin.—Projets et essais d'amélioration des passes depuis un siècle.—État actuel. Par M. Ch. Duffart.—Congrès National des Sociétés Françaises de Géographie. 16e Session. Bordeaux, Août 1895. Compte Rendu. Bordeaux, 1896. Size 10 × 6½, pp. 153–167.

France—Arcachon. **Hautreux.**

Côtes des Landes et bassin d'Arcachon; les vents, les courants, les températures et les densités de la mer. Par M. Hautreux.—Congrès National des Sociétés Françaises de Géographie. 16e Session. Bordeaux, Août 1895. Compte Rendu. Bordeaux, 1896. Size 10 × 6½, pp. 251–268. *Diagrams.*

France—Birth-rate. *Rev. Scientifique* (4) **7** (1897): 97–105. **Levasseur.**

La natalité en France. Par M. E. Levasseur.

France—Gironde. **Fallot.**

La Carte géologique des environs de Bordeaux et les Régions naturelles de la Gironde. Par M. E. Fallot.—Congrès National des Sociétés Françaises de Géographie. 16e Session, Bordeaux, Août 1895. Comptes Rendu. Bordeaux, 1896. Size 10 × 6½, pp. 27–31.

France—Jura. *Annuaire Club Alpin Français* **22**, 1895 (1896): 147–170. **Renauld.**

Le Jura souterrain: troisième campagne, 1895 (la source du Lançot; la grotte du Puits-Billard; la source de l'Ain, la grotte des Nans ou source de l'Angillon, la source du lac de Chalin; la caverne du Bief l'Eurage, la grotte de Jeurre, la source de la Grusse). Par M. Edmond Renauld. *With Plans and Illustration.*

France—Malville. *B.S.G. Com. Saint-Nazaire* **13** (1896): 15–28. **Louvel.**

Monographie de la commune de Malville. Par M. Louvel.

France—Mont Blanc. **Durier and Schrader.**

Annuaire Club Alpin Français **22**, 1895 (1896): 3–45.

Sur les routes du Mont-Blanc: 1° L'arête des Bosses. Par M. Ch. Durier; 2° Une tourmente au Mont-Blanc, 1891. Par M. F. Schrader. *With Illustrations.*

France—Pas-de-Calais. ———

Mayville, an Anglo-French Pleasaunce: its attractions and aims. Illustrations by Phil May. London: T. Fisher-Unwin, [not dated]. Size 10 × 7½, pp. 60. *Map, Plan, and Illustrations. Price 2s. 6d. Presented by La Compagnie de Mayville.*

Mayville does not yet exist; but the company which has been formed to create it have prepared this little book describing the site of the proposed watering-place, a short distance south of Boulogne.

France—Pyrenees. **Guenot.**

Des effets du déboisement dans les Pyrénées. Par M. Guénot.—Congrès National des Sociétés Françaises de Géographie. 16e Session. Bordeaux, Août 1895. Compte Rendu. Bordeaux, 1896. Size 10 × 6½, pp. 182–206.

France—Pyrenees. *Annuaire Club Alpin Français* **22**, 1895 (1896): 104–146. **Belloc.**

Du plateau de Lannemezan au glacier des Gourgs-Blancs (Hautes-Pyrénées). Par M. Émile Belloc. *With Illustrations.*

France—Vosges. *C.Rd.* **124** (1897): 51–54. **Lapparent.**

Sur l'histoire géologique des Vosges. Note de M. A. de Lapparent.

Germany—Bavaria. *Mouvement G.* **13** (1896): 589–593. **Wauters.**

Esthétique des villes. Rothenburg. *With Illustrations.*

An account of a "newly discovered" mediæval town in Bavaria, with pictures of the quaint architecture.

Germany—Brandenburg. *Z. Ges Erdk. Berlin* **31** (1896): 98–105. **Dinse.**

Ein schwedischer Kartograph der Mark Brandenburg aus der Zeit des dreissigjährigen Krieges. Von Dr. Paul Dinse.

Germany—Memel. *Deutsche Rundschau G.* **19** (1897): 145–155. **Zweck.**

Die Stadt Memel und ihre Wasserstrassen nach dem Binnenlande. Von Dr. A. Zweck. *With Map and Illustrations.*

Germany—Saale. *Naturw. Wochenschrift* **12** (1897): 4–7. **Ule.**

Der Wasserhaushalt im Stromgebiet der thüringischen Saale. Von Dr. Willi Ule.

Hungary. *B.S.G. Lyon* **14** (1897): 99–136. **Groffier.**

La Hongrie pittoresque et économique. Par M. Valérien Groffier.

Hungary—Transylvania. *Deutsche G. Blätter* **19** (1896): 194–206. **Braess.**

Im Siebenbürgisch-ungarischen Grenzgebirge. Von Dr. Martin Braess.

Iceland. *Annuaire Club Alpin Français* **22,** 1895 (1896): 287–319. **Eichmüller.**

La région du Myvatn en Islande. Par M. Georges Eichmüller. *With Map and Illustrations.*

Contains some fine photographs of scenery in the north of Iceland.

Iceland—Earthquake. *Globus* **70** (1896): 309–311. **Gebhardt.**

Das Erdbeben auf Island am 26/27 August und 5/6 September 1896. Von Dr. Phil. August Gebhardt. *With Map.*

An account of an earthquake in the neighbourhood of Reykjavik, with a map of the district affected.

Italy—Islands. *Riv. G. Italiana* **3** (1896): 563–568. **Mori.**

L'area delle minori isole italiane. Notizia di Attilio Mori.

Italy—Sicily. *Globus* **71** (1897): 69–71. **Deecke.**

Ueber die sicilianischen Schlammvulkane. Von W. Deecke. Greifswald.

Italy—Vesuvius. *Annuaire Club Alpin Français* **22,** 1895 (1896): 404–464. **Durier.**

Le Vésuve et Capri. Par M. Ch. Durier. *With Illustrations.*

Mediterranean—Crete. *B.S.R. Belge G.* **20** (1896): 433–452. **Hauttecœur.**

La Crète. Par Henry Hauttecœur.

Norway. *Z. Deutsch. u. Oesterr. Alpenvereins* **27** (1896): 1–35. **Richter.**

Aus Norwegen. Von E. Richter. *With Illustrations.*

Russia—Caucasus—Salmon. **Kawraisky.**

Die Lachse der Kaukasusländer und ihrer angrenzenden Meere. Von F. F. Kawraisky. 1st Lieferung. Tiflis, 1896. Size 10½ × 7, pp. 92. *Plates.* [In Russian and German.]

Russia—Kiev. **Baye.**

Kiev, la Mère des Villes Russes. Par le Baron de Baye. Paris: Nilsson, 1896. Size 10 × 6½, pp. 48. *Illustrations.*

A fresh and lively account of the visit of a French tourist to Kiev, with references to the history and antiquities of that famous city.

Russia—Libau. *P.I. Civil Engineers* **126** (1896): 360–374. **Jarintzoff.**

On the construction of the Military Outport at Libau. By Dmitri Theodor Jarintzoff. *With Map and Plans.*

Scandinavia. **Rabot.**

Les limites d'altitude des cultures et des essences forestières dans la Scandinavie septentrionale et les régions adjacentes. Par M. Charles Rabot. Extrait de la Revue Générale de Botanique. Tome viii. (1896), p. 385. Paris: P. Dupont, 1896. Size 10 × 6½, pp. 34. *Diagram.*

On the limits in altitude of various plants and crops in Northern Europe.

Slavonic Ethnography. *Globus* **71** (1897): 11, 12. **Rhamm.**

Die Fortschritte der tschecho-slawischen Ethnographie. Von Karl Rhamm.

Switzerland—Jura. *Annuaire Club Alpin Français* **22**, 1895 (1896): 210–242. **Cuënot.**

Autour de Sainte-Croix (Jura Suisse). Par M. Henry Cuënot. *With Illustrations.*

Switzerland—Rhone. *C.Rd.* **124** (1897): 106–109. **Lugeon.**

Le Rhône suisse tributaire du Rhin. Note de M. Maurice Lugeon.

Arguments to prove that the Rhone in Switzerland was in pliocene times a tributary of the Rhine, from which it was diverted and "captured" by a series of changes due to glaciation and Earth-movement as well as to river erosion.

United Kingdom—England. *P.I. Civil Engineers* **126** (1896): 2–23. **Hill.**

The Thirlmere Works for the Water-Supply of Manchester. By George Henry Hill. *With Plates.*

United Kingdom—England. *Quarterly Rev.* **185** (1897): 117–148. ———

Norfolk.

United Kingdom—England. **Ward.**

Thorough Guide Series. Surrey and Sussex [including Tunbridge Wells]. By C. S. Ward, M.A. Nineteen Maps and Plans, by Bartholomew. London: Dulau & Co., 1887. Size 6½ × 4½, p. xii. and 172. *Price* 3*s.* 6*d. Presented by the Publishers.*

This guide, like others of the series, is plentifully supplied with excellent maps, and the information it contains is carefully selected and revised.

United Kingdom—Ireland. *Nature* **55** (1897): 254–256. **Cole.**

The Bog-Slide of Knocknageeha, in the County of Kerry. By Prof. Grenville A. J. Cole. *With Sketch-Map and Illustration.*

United Kingdom—Scottish Lochs. *Scottish G. Mag.* **13** (1897): 1–21. **Murray.**

Some Observations on the Temperature of the Water of the Scottish Fresh-Water Lochs. By John Murray, D.SC. *With Diagrams.*

These observations were made in Loch Lochy (fresh water) and Loch Etive (sea-water), and in some smaller fresh-water lochs. The data are printed together with a general discussion.

United Kingdom—Wales. *P.I. Civil Engineers* **126** (1896): 24–125. **Deacon.**

The Vyrnwy Works for the Water-Supply of Liverpool. By George Frederick Deacon. *With Plates.*

An account of the creation of an artificial lake on the site of a post-glacial lake-basin, which, from the borings of the engineers, seems to be a true rock-basin filled with alluvium. The reservoir is enclosed by a dam of masonry founded on solid rock.

ASIA.

Asia-Minor. **Sarre.**

Reise in Kleinasien, Sommer 1895. Forschungen zur seldjukischen Kunst und Geographie des Landes. Von Friedrich Sarre. Berlin: D. Reimer, 1896. Size 10½ × 7½, pp. xvi. and 210. *Maps and Illustrations. Price* 16*s.*

Dr. Sarre traversed Asia-Minor from west to east, nearly along the thirty-eighth parallel, through the ancient provinces of Phrygia, Lykaonia, and Pisidia in June and July, 1895. The main object of the journey was the study of early Turkish architecture of the thirteenth century. There are many fine views of natural scenery as well as of architecture.

Asia-Minor—Hierapolis. **Joanne.**

Annuaire Club Alpin Français **22**, 1895 (1896): 320–338.

Une ascension en Asie-Mineure: Hiérapolis et sa cascade pétrifiée. Par M. Paul Joanne. *With Illustrations.*

Asia-Minor—Karia. **Paton and Myres.**

Researches in Karia. By W. R. Paton and J. L. Myres. From the *Geographical Journal* for January, 1897. Size 10 × 6½, pp. 18. *Maps and Illustrations.*

Baluchistan—Kalat. **Tate.**

Government of India. Foreign Department. Kalat. A Memoir on the Country and Family of the Ahmadzai Khans of Kalat. (In two Parts.) From a Manuscript Account by the Akhund Muhammad Sidik, with Notes and Appendices from other Manuscripts, as well as from Printed Books. By Geo. P. Tate. Calcutta, 1896. Size 13½ × 8½, pp. ii., 56, and xii. *Presented by the Author.*

Ceylon. **Cave.**

The Ruined Cities of Ceylon. By Henry W. Cave, M.A. Illustrated with Photographs taken by the Author in the year 1896. London: Low & Co., 1897. Size 11½ × 9, pp. 126. *Price* 38*s*. *Presented by the Publishers.*

This beautiful book will be specially noticed.

China. *A travers le Monde, Tour du Monde* (*n.s.*) **3** (1897): 9–12. ———

Mission commerciale lyonnaise en Chine. De Yun-Nan-Fou vers le Se-Tchouen. *With Illustrations.*

China. **Cordier.**

Les origines de deux établissements Français dans l'Extrême Orient—Chang-haï —Ning-po. Documents inédits publiés avec une Introduction et des Notes par Henri Cordier. Paris: 1896. Size 11 × 7½, pp. xl. and 76. *Plan and Plate.*

China. *Riv. G. Italiana* **3** (1896): 545–558. **Nocentini.**

Gli interessi italiani nella Cina del Prof. Lodovico Nocentini.

Chinese Empire—Lob Nor. *Z. Ges. Erdk. Berlin* **31** (1896): 295–361. **Hedin.**

Dr. Sven Hedin's Forschungsreise nach dem Lop-nor, Januar bis Mai 1896. *With Maps.*

Bemerkungen zur Kenntnis des Lop-nor-Gebietes und zur geographischen Nomenklatur in Central-Asien. Von Dr. Sven Hedin.

French Indo-China. *B.S.G. Paris* (7) **17** (1896): 392–398. **d'Enjoy.**

La voie ferrée de Bassac à Saïgon. Par Paul d'Enjoy. *With Map.*

India. ———

G. V. Juggarow Observatory, Duba Gardens, Vizagapatam, maintained by Mrs. A. A. Nursingrow. Results of Meteorological Observations, 1894. Vizagapatam, 1896. Size 8 × 5, pp. vi. and 132. *Diagrams.*

India—Bombay Observations. ———

Magnetical and Meteorological Observations at the Government Observatory, Bombay, 1895, made, reduced, and tabulated under the direction of Charles Chambers, and N. A. F. Moos, B.SC. With an Appendix. Bombay, 1896. Size 14 × 10, pp. 6, xvi., 16, 12, and 10.

India—Burma. **Carey.**

Diary of Second Lieutenant E. S. Carey, 2nd Royal Inniskilling Fusiliers, Intelligence Officer, Jade Mines Escort. Rangoon, 1896. Size 13 × 8½, pp. [26]. *Maps. Presented by the Quartermaster-General in India.*

India—Burma. ———

Report on the Internal Trade of Burma for the Three Years ending the 31st March, 1896. Rangoon, 1896. Size 13 × 8½, pp. 8 and lxviii. *Map.*

India—Burma. **Harvey.**

Report on the Thetta Column and Work in the Southern Chin Hills during the season 1894–95. By Captain John Harvey, R.A. Rangoon, 1895. Size 13½ × 9, pp. 16, 8, 6, and 6. *Maps. Presented by the Quartermaster-General in India.*

India—Burma. **Rigby.**

Report on a Tour through the Northern Shan States. By Lieut. G. C. Rigby. Season 1894–95. Rangoon, 1895. Size 13½ × 8½, pp. 26 and lxii. *Maps and Illustrations. Presented by the Quartermaster-General in India.*

India—Burma. **Turner.**

Report on the Kairuma, Naring, and Daidin Columns, Chin Hills, 1895–96. By Lieut. C. H. Turner. Rangoon, 1896. Size 13½ × 8½, pp. 20, 6, 2, 4, 6, 2, 2. *Maps and Illustrations. Presented by the Quartermaster-General in India.*

India—Burma. **Turner.**

Report on the Sana Kachin Expedition, 1895-96. By Lieut. M. N. Turner. Rangoon, 1896. Size 13½ × 8½, pp. 22, 4, 8, 2, 2, 4, 4, 4. *Maps and Illustrations. Presented by the Quartermaster-General in India.*

Kafiristan. **Raverty.**

The Káfiristán and the Káfiri Tribes. By Major H. G. Raverty. Reprinted from the *Calcutta Review* for July, 1896. Size 9 × 5½, pp. 46. *Presented by the Author.*

Kafiristan. *Oesterr. Monatschr. Orient.* **22** (1896): 129–132. **Vambéry.**

Kafiristan und die Kafiren. Von H. Vambéry.

An appreciation of Sir George Robertson's book in Prof. Vambery's characteristically entertaining style.

Malay Archipelago—Borneo. **Kühr.**

Bijd. Taal-, Land- en Volkenk. Ned.-Indie (6) **3** (1897): 57–82.

Schetsen uit Borneo's Westerafdeeling. Door E. L. M. Kühr. *With Illustration.*

Malay Archipelago—Celebes. **Sarasin.**

A travers le Monde, Tour du Monde (n.s.) **3** (1897): 33–36.

Exploration de Célèbes. Par P. and F. Sarasin. *With Illustrations.*

Malay Archipelago—Java. **Van der Kemp.**

Bijd. Taal-, Land- en Volkenk. Ned.-Indie (6) **3** (1897): 1–48.

De economische oorzaken van den Java-oorlog van 1825–30. Door P. H. van der Kemp.

Palestine. *Palestine Exploration Fund, Quarterly Statement* (1897): 44–53. **Chaplin.**

The visit of David the Reubenite to Hebron and Jerusalem in A.D. 1523. By Thomas Chaplin, M.D.

This short account of the visit of David the Reubenite to Hebron is followed by a "Note on the Hebron Haram," by Canon Dalton.

Palestine. **Smith.**

The Historical Geography of the Holy Land, especially in relation to the history of Israel and of the Early Church. By George Adam Smith, D.D. With six maps. Seventh Thousand, with Additions, Corrections, and New Index of Scripture References. London: Hodder and Stoughton, 1897. Size 9½ × 6, pp. xxvi. and 714. *Price* 15*s*. *Presented by the Publishers.*

This new edition retains all the excellent features of the first edition, reviewed at length in the *Journal*, vol. iv. (1894), p. 450; it also embodies the results of recent Palestine research, and contains additional indexes and notes of great value.

Persia. **Houtum-Schindler.**

Eastern Persian Irak. By General A. Houtum-Schindler. London: John Murray, 1896. Size 8½ × 5½, pp. viii. and 132. *Map.*

One of the additional publications of the Royal Geographical Society.

Persia—Meshed. *Globus* **70** (1896): 315–321, 334–338. **Minkevitch.**

Reise nach Mesched in Persien. Von Dr. Georg Minkevitch.

The author travelled from Askhabad to Meshed in company with an interpreter. He gives a general description of the journey and of the town.

Russia—Caucasus. *Annuaire Club Alpin Français* **22**, 1895 (1896): 339–359. **Gallois.**

La traversée du Caucase par la route de Géorgie (de Tiflis à Vladikavkaz); de Tiflis à Érivan; le mont Ararat. Par M. Eugène Gallois. *With Map and Illustrations.*

Russia—Transcaucasia. **Bryce.**

Transcaucasia and Ararat; being Notes of a Vacation Tour in the Autumn of 1876. By James Bryce. Fourth Edition Revised, with a Supplementary Chapter on the Recent History of the Armenian Question. London: Macmillan & Co., 1896. Size 8 × 6, pp. xx. and 526. *Map. Price* 8*s*. 6*d*.

This edition of this standard work contains a series of footnotes, bringing the description of the province of Transcaucasia up to date, while a new chapter is added on the present aspect of the Armenian question.

Russia—Siberia. *Mém. A. Imp. Sci. St. Pétersbourg* (8) **2** (1895): 1–26. **Stelling.**

Magnetische Beobachtungen auf einer Reise nach Urga im Sommer 1893 nebst Bemerkungen über die Änderungen der erdmagnetischen Elemente in Ost-Sibirien. Von Ed. Stelling.

Russian Seal Islands. **Stejneger.**

U.S. Commission of Fish and Fisheries, John J. Brice, Commissioner. The Russian Fur-Seal Islands. By Leonhard Stejneger. Extracted from U. S. Fish Commission Bulletin for 1896. Art. I., pp. 1–148, plates 1–66. Washington, 1896. Size 11½ × 8.

This fully illustrated memoir will be specially referred to.

Syria. **Heber-Percy.**

Moab, Ammon, and Gilead. By Algernon Heber-Percy. Market Drayton: Bennion, Horne, Smallman & Co., 1896. Size 9 × 6, pp. viii. and 102. *Map and Illustrations. Presented by the Publishers.*

An unassuming account of an interesting journey east of the Dead sea, from Medeba to the river Arnon in the south to Mezarib, east of the Sea of Galilee, in the north. The illustrations of Arabs and ruins are all good.

AFRICA.

Africa. **Heawood.**

Geography of Africa. By Edward Heawood, M.A. London: Macmillan & Co., 1896. Size 7 × 5, pp. xii. and 262. *Map and Illustrations. Price* 2*s.* 6*d. Presented by the Publishers.*

A special note will be given on this book.

Africa—French Explorations. *Rev. Française* **22** (1897): 5–17. **Maunoir.**

Les explorations françaises en Afrique en 1896. Par Ch. Maunoir. *With Map.*

French explorations in the Sahara (with a sketch-map of M. Foureau's journey), in the Sudan and in Central Africa during 1896, form the subject of this short article.

Central Africa. *J.R. Colonial I.* **28** (1897): 94–119. **Johnston.**

England's Work in Central Africa. By Sir Harry H. Johnston, K.C.B.

Congo State. **Hinde.**

The Fall of the Congo Arabs. By Sidney Langford Hinde. London: Methuen & Co., 1897. Size 9 × 6, pp. viii. and 308. *Map and Portrait. Price* 12*s.* 6*d. Presented by the Author. Another copy presented by the Publisher.*

This will be specially noticed.

Egypt. **Pensa.**

L'Égypte au point de vue économique et les intérêts français. Par M. Henri Pensa.—Congrès National des Sociétés Françaises de Géographie. 16e Session. Bordeaux, Août 1895. Compte Rendu. Bordeaux, 1896. Size 10 × 6½, pp. 227–236.

French West Africa. *A travers le Monde, Tour du Monde (n.s.)* **3** (1897): 17–90. ———

Le Chemin de fer du Sénégal au Niger. *With Illustrations and Map.*

French West Africa—Dahomey. **Martin.**

Miss Catholiques **28** (1896): 562–564, 568–569, 581–584, 595–597.

A travers le Dahomey. Par le R. P. Martin. *With Illustrations.*

French West Africa—Dahomey. **Plé.**

A travers le Monde, Tour du Monde (n.s.) **3** (1897): 1–4.

Une Délimitation de Frontière au Dahomey. Notes sur l'importante mission du capitaine Plé. *With Map and Illustrations.*

German East Africa. **Stuhlmann and Schlobach.**

M. Deutsch. Schutzgeb. **9** (1896): 247–249.

Die Höhenmessungen Dr. Stuhlmanns während drei Reisen in dem Jahre 1894 in Usaramo, Ukami, Uluguru u. s. w., und von Premier-lieutenant Schlobach in den Jahren 1894–95 in den gleichen Gebieten.

German East Africa—Wahehe. *Verh. Ges. Erdk. Berlin* **23** (1896): 467–492. **Wenle.**

Herr Dr. K. Wenle: Die Wahehe.

German East Africa—Usambara. **Buchwald.**

M. Deutsch. Schutzgeb. **9** (1896): 213–233.

Beitrag zur Gliederung der Vegetation von West-Usambara. Von Dr. phil. Johannes Buchwald.

German South-West Africa. *Globus* **71** (1897): 94, 95. **Brincker.**

Beschreibung der "Éumbo" des Häuptlings der ovakuánjama in Nord-Ovamboland. Von P. H. Brincker. *With Illustration.*

A plan of the residence of an Ovambo chief, showing the remarkable labyrinthine passages by which the entrances are guarded.

German South-West Africa—Cunene. *M. Deutsch. Schutzgeb.* **9** (1896): 209–219. **Esser.**

Ueber das Gebiet an der Kunenemündung. Von Dr. jur. Esser. *With Map.*

German West Africa—Togo. *M. Deutsch. Schutzgeb.* **9** (1896): 189–208. **Klose.**

Bericht über eine Reise von der Station Misahöhe über Kete und Kratyi nach Salaga Ende des Jahres, 1894. Von H. Klose.

Niger. *Rev. Scientifique* (4) **7** (1897): 108–110. **Hourst.**

La Mission hydrographique du Niger. Par M. Hourst.

Réunion. *Rev. Française* **22** (1897): 18–23. **O'Zoux.**

La population de la Réunion. Par L. O'Zoux.

Somaliland. *Globus* **70** (1896): 331–334, 349–352. **Keller.**
Reisestudien in den Somaliländern. Von Prof. Dr. C. Keller. Zürich. V.
A description of the Somali people and their mode of life.

Somaliland—Magadoxo. ———
A travers le Monde, Tour du Monde (n.s.) **3** (1897): 29–30.
Le Massacre de la mission Cecchi. *With Illustration and Portrait.*

South Africa—Barotse Country. **Bertrand.**
A travers le Monde, Tour du Monde (n.s.) **3** (1897): 25–28.
Une Expédition au Pays des Barotsé. Par M. Alfred Bertrand. *With Illustrations.*

South Africa. *Deutsche G. Blätter* **19** (1896): 206–215. **Sonnewald.**
Südafrikanische Tierseuchen mit besonderer Berücksichtigung der Rinderpest in ihrer geographischen Bedeutung. Von Tierarzt A. Sonnewald.

Transvaal. *Verh. Ges. Erdk. Berlin* **23** (1896): 492–507. **Passarge.**
Herr Dr. S. Passarge über seine Reisen in Transvaal.

Tunis and Algeria. *Annuaire Club Alpin Français* **22**, 1895 (1896): 243–286. **Bouchard.**
Voyage en Tunisie et en Algérie, organisé par la Section des Hautes Vosges. Par M^me^ Paul Bouchard. *With Illustrations.*

West Africa. *B.S.G. Paris* (7) **17** (1896): 337–363. **Cuny.**
De Libreville au Cameroun. Par C. Cuny. *With Map.*

West Africa. **Kingsley.**
Travels in West Africa, Congo Français, Corisco and Cameroons. By Mary H. Kingsley. London: Macmillan & Co., 1897. Size 9½ × 6, pp. xvi. and 744. *Illustrations. Price* 21*s*. *Presented by the Publishers.*
This book is specially noticed in the Monthly Record.

NORTH AMERICA.

America—Anthropology. **Preuss.**
Dr. Konrad Theodor Preuss. Menschenopfer und Selbstverstümmlung bei der Todtentrauer in Amerika. Eine Darstellung der Natur des Gewissens vermittelst der vergleichenden Völkerpsychologie. (Sonder-Abdruck aus der Bastian-Festschrift.) Berlin: D. Reimer, 1896. Size 11 × 7½, pp. 36. *Presented by the Author.*

Canada—Barren Grounds. **Whitney.**
On Snow-Shoes to the Barren Grounds. Twenty-eight Hundred Miles after Musk-Oxen and Wood-Bison. By Caspar Whitney. London: Osgood, McIlvaine & Co., 1896. Size 9½ × 6½, pp. x. and 324. *Illustrations. Price* 16*s*.
A well-told and illustrated narrative of a sporting trip due north of Great Slave Lake, nearly to the Arctic sea.

Canada—British Columbia. *Trans. R.S. Canada* (2) **1** (1895): 103–122. **Hill-Tout.**
Later Prehistoric Man in British Columbia. By Charles Hill-Tout. *With Illustrations.*

Canada—Historical. *Trans. R.S. Canada* (2) **1** (1895): 25–61. **Gosselin.**
Les Jésuites au Canada. Le P. de Bonnécamps, dernier professeur d'hydrographie au collège de Québec, avant la conquête (1741–1759). Par M. l'Abbé Auguste Gosselin.

Canada—New Brunswick. *Trans. R.S. Canada* (2) **1** (1895): 91–102. **Ganong.**
A Plan for a General History of the Province of New Brunswick. By William F. Ganong.
A complete table of contents for a projected history of New Brunswick.

Canada—Nova Scotia. *Trans. R.S. Canada* (2) **1** (1895): 81–90. **Brymner.**
The Jamaica Maroons—How they came to Nova Scotia—How they left it. By D. Brymner, LL.D.

Great American Lakes. *Globus* **71** (1897): 8–11. **Greim.**
Die Entstehung der nordamerikanischen grossen Seen. Von Dr. G. Greim. *With Maps.*

Labrador. *Deutsche Rundschau G.* **19** (1897): 164–170. **Bach.**
Labrador. Reiseskizze von Rudolf Bach in Montreal. *With Illustrations.*

North America. *American Naturalist* **30** (1896): 886–902, 1003–1026. **Cope.**

The Geographical Distribution of Batrachia and Reptilia in North America. By E. D. Cope.

United States. *Science* (*n.s.*) **5** (1897): 1–15, 42–51. **Emmons.**

The Geology of Government Explorations. By S. F. Emmons.

The articles are of equal interest to geographers and geologists, as topographical and geological surveys in the United States have always gone on together.

United States—Alaska. **Reid.**

Glacier Bay and its Glaciers. By H. F. Reid. In the *Sixteenth Annual Report* of the United States Geological Survey, 1894–95, part i. pp. 421–468. *Maps and Illustrations.*

A study of the glaciers and the glacial geology of Glacier bay, with a number of maps and fine photographs.

United States—California. *J. Geology* **4** (1896): 881–906. **Lindgren and Knowlton.**

The Age of the Auriferous Gravels of the Sierra Nevada. By Waldemar Lindgren. With a Report on the Flora of Independence Hill. By F. H. Knowlton. *With Map.*

United States—Geological Survey Report. ———

Sixteenth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1894–95. Charles D. Walcott, Director. In Four Parts. Part i. Director's Report and Papers of a Theoretic nature; Part ii. Papers of an Economic Character; Part iii. Mineral Resources of the United States, 1894—Metallic Products; Part iv. Ditto—Nonmetallic Products. Washington, 1895–96. Size 12 × 8¼, pp. (part i.) xxii. and 910, (part ii.) xx. and 598, (part iii.) xiv. and 646, (part iv.) xviii. and 736. *Maps and Plates. Presented by the Survey.*

United States—Survey. **Gannet.**

Summary of primary triangulations executed between the years 1882 and 1894. By Henry Gannet. Methods and instruments employed, and areas covered. In the *Sixteenth Annual Report* of the United States Geological Survey for 1894–95. Part i. pp. 877–885. *Map.*

The map shows the state and progress of the survey for the year 1894–95.

CENTRAL AND SOUTH AMERICA.

Argentine Andes. *Z. Deutsch. u. Oesterr. Alpenvereins* **27** (1896): 36–61. **Habel.**

Aus den argentinischen Anden. Von Jean Habel. *With Illustrations.*

Bolivier—Beni. *Deutsche Rundschau G.* **19** (1896): 115–125. **Nusser—Asport.**

Der Rio Beni von seinen Quellen bis zu seiner Mündung. Von Chr. Nusser-Asport.

Brazil—Bahia. *Rev. Trim. I.G. e Hist. Bahia* **3** (1896): 305–312. **Oliveira.**

A Zona Austral da Bahia. Dr. Sá Oliveira.

Brazil—Bahia and Espirito-Santo. ———
Rev. Trim. I.G. e Hist. Bahia **3** (1896): 313–327.

Estudos sobre os Limites entre os Estados da Bahia e Espirito-Santo.

Brazil—Piauhy. *L'Universo* **6** (1896): 337–339. **Reminolfi.**

Risorse naturali del Piauhy. (Brasile Settentrionale.) Avv. Giuseppe Reminolfi.

Brazilian Frontier. **Doby.**

Question du Contesté Franco-Brésilien. Par M. V. Doby.—Congrès National des Sociétés Françaises de Géographie, 16e Session, Bordeaux, Août 1895. Compte Rendu. Bordeaux, 1896. Size 10 × 6½, pp. 282–293.

Central America. *J. Geology* **4** (1896): 938–947. **Sapper.**

Geology of Chiapas, Tabasco and the Peninsula of Yucatan. By Carlos Sapper. Translated by C. Joaquina Maury and G. D. Harris. *With Map.*

Colombia. *Naturwiss. Wochenschrift* **12** (1897): 1–4, 37–39. **Regel.**

Reisebriefe aus Colombia. Von Prof. Dr. Fr. Regel. Zwei Ausflüge von Medellin nach dem Westen von Antioquia (im September 1896).

Prof. Regel writes from Medellin, giving an account of his journey from Bremen, and including a series of air and sea-temperatures taken twice daily between Havre and St. Thomas, West Indies.

Peru. **Carvajal.**

Report on the Navigability of the Eastern Rivers of Peru. By Captain M. Meliton Carvajal, of the Peruvian Navy. Lima, 1896. Size 8½ × 6, pp. 12. *Map.*

South America—West Coast. ———

No. 89. U.S. Hydrographic Office. The West Coast of South America, including Magellan Strait, Tierra del Fuego, and the outlying Islands. Second Edition. Washington, 1896. Size 9½ × 6, pp. 496. *Charts.*

Venezuela. *Deutsche G. Blätter* **19** (1896): 183–194. **Eggers.**

Die Asphalt-Quellen am See von Maracaibo. Von Baron H. Eggers. *With Map.*

Venezuela. *Petermanns M.* **42** (1896): 197–201. **Sievers.**

Karten zur physikalischen Geographie von Venezuela. Von Prof. Dr. W. Sievers. *With Map.*

A note on these maps was given in the *Journal* for December, vol. viii. (1896) p. 638.

Venezuela and British Guiana. ———

Brief submitted by Venezuela to the Commission appointed "to investigate and report upon the true Divisional Line between the Republic of Venezuela and British Guiana." Size 9½ × 6, pp. 28.

Venezuela and British Guiana. **Strickland.**

Documents and Maps on the Boundary Question between Venezuela and British Guayana from the Capuchin Archives in Rome, with a brief summary of the Question, by the Rev. Joseph Strickland, S.J., Rome. London: G. Philip & Son, 1896. Size 12½ × 8½, pp. xxxvi. and 76. *Price* 10*s.* 6*d.* *Presented by the Publishers.*

This interesting work includes four chapters, entitled respectively, "The meaning of Guayana and Essequibo," "The extent of Spanish colonization in Guayana," "The extent of Dutch colonization in Guayana," "The case between Venezuela and England." Then follow a series of valuable Spanish documents, relating to the Jesuit missionaries in Guiana, and the reproductions of five manuscript maps.

West Indies—Cuba. *Rev. Française* **21** (1896): 561-573. ———

L'Insurrection de Cuba, et les intérêts de l'Espagne.

West Indies—Jamaica. ———

Institute of Jamaica. Jamaica in 1896. A Handbook of Information for intending Settlers and others. Kingston, Jamaica: Institute of Jamaica, 1896. Size 8½ × 5½, pp. viii. and 88. *Map. Presented by the Institute of Jamaica.*

An official epitome of up-to-date information regarding Jamaica.

AUSTRALASIA AND PACIFIC ISLANDS.

Ellice Group. **Hedley.**

Australian Museum, Sydney. Memoir III. The Atoll of Funafuti, Ellice Group: its Zoology, Botany, Ethnology, and General Structure based on collections made by Mr. Charles Hedley, of the Australian Museum, Sydney, N.S.W. Part i. Published December 21, 1896. Sydney, 1896. Size 10 × 6½, pp. 86. *Illustrations.*

Hawaii. *American J. Science* (4) **2** (1896): 421–429. **Lyons.**

Chemical Composition of Hawaiian Soils, and of the Rocks from which they have been derived. By A. B. Lyons.

Marshall Islands. *M. Deutsch. Schutzgeb.* **9** (1896): 256–260. ———

Resultate der meteorologischen Beobachtungen in Jaluit im Jahre 1895.

New Zealand. **Harper.**

Pioneer Work in the Alps of New Zealand. A Record of the First Exploration of the chief Glaciers and Ranges of the Southern Alps. By Arthur P. Harper, B.A. London: T. Fisher Unwin, 1896. Size 9 × 6, pp. xvi. and 336. *Map and Illustrations. Price* 21*s.* *Presented by the Publisher.*

This book is noticed in the Monthly Record.

New Zealand. ———

Statistics of the Colony of New Zealand for the year 1895. Wellington, 1896. Size 13½ × 8½, pp. xii. and 454.

The complete statistical report for 1895 is preceded by a summary of the statistics since the beginning of the colony.

Samoa. *Ann. Hydrographie* **24** (1896): 482–483. **Winkler.**
Zur Hydrographie der Samoa-Inseln. Aus dem Reisebericht S.M.S. *Bussard*, Kommandant Korv.-Kapt. Winkler. *With Chart.*
Contains a chart of the anchorage at Aleipata.

South Australia and Tasmania. **Tate and Dennant.**
Trans. R.S. South Australia **20** (1896): 118–148.
Correlation of the Marine Tertiaries of Australia. Part iii., South Australia and Tasmania. With General Remarks and Appendices. By Professor Ralph Tate and J. Dennant. *With Plate.*

Tasmania—Glaciation. *P.R.S. Tasmania*, 1894–95 (1896): 56–65. **Moore.**
Further Discoveries of Glaciation in Tasmania. By T. B. Moore.

Tasman's Voyage. *P.R.S. Tasmania*, 1894–95 (1896): 27–33. **Mault**
Note on a Manuscript Chart in the British Museum, showing Tasman's Tracks in the Voyage of 1642–4. By A. Mault. *With Chart.*

POLAR REGIONS.

Arctic. **Nansen.**
Fridtjof Nansen's 'Farthest North,' being the Record of a Voyage of Exploration of the ship *Fram*, 1893–96, and of a Fifteen Months' Sleigh Journey by Dr. Nansen and Lieut. Johansen, with an Appendix by Otto Sverdrup, Captain of the *Fram*, about One Hundred and Twenty full-page and numerous text Illustrations, sixteen Coloured Plates in facsimile from Dr. Nansen's own sketches, etched Portrait, Photogravures, and Maps. 2 vols. London: A. Constable & Co., 1897. Size 10 × 7, pp. (vol. i.) xvi. and 510; (vol. ii.) xiv. and 670. *Price* 42*s.* *Presented by the Publishers.*
This will be specially noticed.

Arctic. *Rev. Scientifique* (4) **7** (1897): 65–72. **Rabot.**
Les explorations arctiques en 1896. Par M. Ch. Rabot.

Franz Josef Land. **Brice.**
The Jackson-Harmsworth Polar Expedition. By Arthur Montefiore Brice. From the *Geographical Journal* for December, 1896. Size 10 × 6½, pp. 24. *Illustrations.*

Franz Josef Land. *Globus* **71** (1897): 44–48. **Lindeman.**
Franz-Joseph-Land. Kontroversen und neue Entdeckungen. Von Dr. M. Lindeman. *With Map.*
Refers to the work of Payer and of Jackson.

MATHEMATICAL GEOGRAPHY.

Astronomical. *Deutsche Rundschau G.* **19** (1896): 97–101. **Hegner-Rezelfeld.**
Ein Beitrag zur physikalischen Geographie. Erläuterung zur "Kartographischen Darstellung der täglichen Bewegung der Erde." Von J. v. Hegner-Rezelfeld. *With Plate.*

Nautical Almanac. ——
The Nautical Almanac and Astronomical Ephemeris for the year 1900, for the Meridian of the Royal Observatory at Greenwich. Published by order of the Lords Commissioners of the Admiralty. Also Part i. (containing such portions as are essential for navigation). London: Eyre & Spottiswoode. Size 9 × 6, pp. xiv, 638, 18, and 8; (Part i.) xiv. and 314. *Price* 2*s.* 6*d.* *Part I.* 1*s.* *Presented by the Admiralty.*

Positions at Sea. *Nautical Mag.* **65** (1896): 1117–1127. **Goodwin.**
Ex-Meridians—Ancient and Modern. By H. B. Goodwin.
On ex-meridian altitudes for the determination of positions.

Position Determinations. *Petermanns M.* **42** (1896): 252–258, 275–280. **Harzer.**
Ueber geographische Ortsbestimmungen ohne astronomische Instrumente. Von Prof. Dr. P. Harzer.

Position Determinations. *Ann. Hydrographie* **24** (1896): 458–463. **Lüning.**
Graphische Darstellung der Fehlergleichungen für Längen- und Breitenbestimmungen. Von Theodor Lüning.
A method for showing the effect of a given error in observation on the position of a ship by constructing diagrams.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Lunar and Terrestrial Mountains. **Puiseux.**

Annuaire Club Alpin Français **22**, 1895 (1896): 363–403.

Les montagnes de la Lune. Par M. Pierre Puiseux.

M. Puiseaux describes the characteristic forms of lunar mountains with reference to the probable mode of origin, and compares them with terrestrial features.

Oceanography. *Globus* **70** (1896): 325-329. **Schott.**

Die Hydrographie der skandinavischen Gewässer in ihrer Bedeutung für die Fischerei. Von Dr. Gerhard Schott. Hamburg. *With Illustrations.*

A report of the work accomplished by Prof. Pettersson, with international co-operation, in the seas surrounding Southern Scandinavia.

Oceanography and Climate. **Hautreux.**

Les Glaces de Terre-Neuve et notre climat. Les Trajets des tempêtes dans l'hémisphère Nord. Par M. Hautreux.—Congrès National des Sociétés Françaises de Géographie. 16e Session, Bordeaux, Août 1895. Compte Rendu. Bordeaux, 1896. Size 10 × 6½, pp. 81–89.

Oceanography—Fisheries. **Layec.**

La situation de la pêche côtière en France et la vulgarisation des notions d'océanographie. Par M. Layec.—Congrès National des Sociétés Françaises de Géographie. 16e Session. Bordeaux, Août, 1895. Compte Rendu. Bordeaux, 1896. Size 10 × 6½, pp. 136–153.

Oceanography—Mediterranean. ———

Berichte der Commission für Erforschung des östlichen Mittelmeeres. Fünfte Reihe. (Aus den Denkschriften der Kais. Akademie der Wissenschaften in Wien. Bd. lxiii.) [Not dated.] Size 12 × 9½, pp. 118. *Plates.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropology. *Contemporary Rev.* **70** (1896): 761–783. **Reclus.**

The Progress of Mankind. By Elisée Reclus.

Historical Maps. *Rev. G.* **39** (1896): 324–333. **Harrisse.**

La cartographie verrazanienne. Par H. Harrisse.

Historical—Ophir. *Oesterr. Monats. Orient* **22** (1896): 76–89, 111–126. **Feigl.**

Das Goldland Ophir. Von Hermann Feigl. *With Map.*

The author brings forward evidence for regarding Sofala as Ophir, and for believing that the ships of Hiram were in the habit of sailing from Eziongeber, on the Red Sea, round the south of Africa to Tartessus.

Native Races. *B.S. d'Études colon.* **3** (1896): 109–136. ———

Relations des Blancs avec les Indigènes. (Extrait du *Manuel du Voyageur et du Résident au Congo.*)

Naval History. **Mahan.**

Rev. Maritime et Colon. **121** (1894): 339, 497; **122** (1894): 5, 344, 552; **123** (1894): 328; **126** (1895): 205; **127** (1895): 323; **128** (1896): 95, 211, 470; **129** (1896): 65, 463; **130** (1896): 82, 250.

Influence de la puissance maritime sur l'histoire [1660–1783]. Par M. A.-T. Mahan; traduit de l'anglais. Par M. Boisse.

This is a translation of Captain Mahan's great work, 'The Influence of Sea-power upon History.'

BIOGRAPHY.

Burton. **Stisted.**

The True Life of Capt Sir Richard F. Burton, K.C.M.G., F.R.G.S., etc. Written by his niece, Georgiana M. Stisted. London: H. S. Nichols, 1896. Size 7½ × 5½, pp. xvi. and 420. *Portrait. Price 5s. Presented by the Author.*

Miss Stisted gives a thoroughly readable account of the life of Sir Richard Burton, and expresses the views of his relatives on certain passages in the biography written by the late Lady Burton.

Cassini. *Rev. G.* **39** (1896): 241–251. **Drapeyron.**

La vie et les travaux géographiques de Cassini de Thury, auteur de la première carte topographique de France. Par L. Drapeyron.

Cotteau. *A travers le Monde, Tour du Monde (n.s.)* **3** (1897): 38–39. ———
Edmond Cotteau. *With Portrait.*

Denhardt. *Deutsche Rundschau G.* **19** (1896): 132–134. ———
Gustav Denhardt. *With Portrait.*

Egli. *G.Z* **2** (1896): 601–605. **Oppermann.**
Prof. Dr. J. J. Egli. Von Edmund Oppermann.

Gama. *Deutsche Rundschau G.* **19** (1897): 183–185. ———
Vasco da Gama. *With Portrait.*

GENERAL.

Almanac. ———
Annuaire pour l'An 1897, publié par le Bureau des Longitudes. Avec des Notices scientifiques. Paris: Gauthier-Villars et Fils. Size 6 × 4, pp. vi., 738, 32, 20, 14, 36, 12, 4, 4, 18, and 40.

This is the 101st annual issue of this important almanac.

Almanac. **Olsen.**
1897. The Fisherman's Nautical Almanack and Tide Tables. A Directory of British and Foreign Fishing Vessels, Steamers, etc. By O. T. Olsen. London: J. D. Potter. Size 7½ × 5, pp. 420. *Plan. Price* 1*s. Presented by the Compiler.*

Anthropology. **Steinen.**
Karl von den Steinen. Prähistorische Zeichnen und Ornamente (Sonder-Abdruck aus der Bastian-Festschrift). Berlin: D. Reimer, 1896. Size 11 × 7½, pp. 42. *Illustrations.*

Anthropology—Lake Dwellings. *P.R.S. Edinburgh* **20** (1895): 385–411. **Munro.**
A Sketch of Lake-dwelling Research. By Robert Munro.

Ballooning. *J. and P.R.S. New South Wales* **29** (1895): 40–47. **Hargrave.**
Paper on Aeronautical Work. By Lawrence Hargrave. *With Plates.*

Ballooning. **Andrée.**
Bihang K. Svensk. Vetens.-Ak. Handl. **21** (1895): 1–13, 1–20, 1–20.

Iakttagelser under en ballongfärd den 4 Augusti, 1894, 29 November 1894, 17 Mars 1895. Af S. A. Andrée. *With Plates.*

Ballooning. **Sohncke.**
Ueber die Bedeutung wissenschaftlicher Ballonfahrten. Festrede gehalten in der öffentlichen Sitzung der K. b. Akademie der Wissenschaften zu München am 15 November 1894. Von L. Sohncke. München: 1894. Size 11½ × 9, pp. 24. *Presented by the Author.*

Bibliography. ———
Summary of the Original Articles which have appeared in the Canadian *Naturalist.* Size 9 × 6, pp. [28].

This is not a summary in the sense usually given to the word, but a table of contents of each of the eight volumes of the first series and the ten volumes of the second series. No dates are given.

Bibliography. **Baschin.**
Bibliotheca Geographica. Herausgegeben von der Gesellschaft für Erdkunde zu Berlin, bearbeitet von Otto Baschin. Band II. Jahrgang, 1893. Berlin: H. W. Kühl, 1896. Size 9½ × 6, pp. xvi. and 384. *Presented by the Geographical Society of Berlin.*

This invaluable bibliography is noticed in the *Journal* for February, p. 227.

Bibliography. ———
Katalog der Bibliothek der Geographischen Gesellschaft in München. München, 1896. Size 8½ × 6, pp. viii. and 102.

Bibliography. ———
General Index to the Fourteen Volumes of the Proceedings of the Royal Geographical Society, New Series, 1879–1892. London: Royal Geographical Society, E. Stanford, 1896. Size 10 × 6½, pp. xx. and 250. *Price to Fellows,* 2*s.; to Non-Fellows,* 5*s.*

A note on this index appears in the *Journal* for February, p. 218.

Bibliography—French Literature. **Jordell—Lorenz**

Catalogue Général de la Librairie Française, continuation de l'ouvrage d'Otto Lorenz (Période de 1840 à 1885, 11 volumes) Tome Treizième (Table des Matieres du Tome xii., 1886-1890). Rédigé par D. Jordell. Deuxième Fascicule, L—Z. Paris: Librairie Nilsson, 1896. Size 10 × 6½, pp. [236].

British Empire. *Trans. R.S. Canada* (2) **1** (1895): 3-43. **Bourinot.**

The Canadian Dominion and proposed Australian Commonwealth: a Study in Comparative Politics. By J. G. Bourinot.

British Empire. *Quarterly J. Geolog. S.* **52** (1896): 651-668. **Montessus de Ballore.**

Seismic Phenomena in the British Empire. By M. F. de Montessus de Ballore. (Translated by L. L. Belinfante.) *With Maps.*

Contains statistics of Earthquakes and seismic maps of the British Isles, India, Australia, Africa, Canada, the West Indies, and appeals for a more systematic study of earthquake phenomena.

British Empire. ——

Statistical Abstract for the several Colonial and other Possessions of the United Kingdom in each year from 1881 to 1895. London: Eyre & Spottiswoode, 1896. Size 10 × 6½, pp. 272.

Colonization. **Barbier.**

Rapport sur la question des renseignements coloniaux. Par M. J.-V. Barbier.—Congrès National des Sociétés Françaises de Géographie, 16e Session. Bordeaux, Août 1895. Compte Rendu. Bordeaux, 1896. Size 10 × 6½, pp. 108-136.

Colonization. **Dodd.**

Essays on Colonizing and Changes in the Past, Present, and Future of the World. Compiled by Robert Dodd. Carlisle: Muir & Co.; London: Printed by W. Reeves, 1896. Size 7½ × 5, pp. xvi. and 102. *Price* 1*s*

A compilation suggestive of the essays of an intelligent schoolboy.

Cotton. **Dabney.**

U.S. Department of Agriculture. Bulletin No. 33. The Cotton Plant: its history, botany, chemistry, culture, enemies, and uses. Prepared . . . with an Introduction by Charles W. Dabney, junr., PH.D. Washington, 1896. Size 9½ × 6, pp. 434. *Illustrations. Presented by the U.S. Department of Agriculture.*

A monograph of the economics of raw cotton, with special regard to the United States, but referring also to the conditions in other producing countries. A coloured map of the typical soil areas of the cotton belt in the southern states is given.

East India Company. ——

Letters received by the East India Company from its servants in the East. Transcribed from the "Original Correspondence" Series of the India Office Records. Vol. i., 1602-1613. With an Introduction by Frederick Charles Danvers. London: Low & Co., 1896. Size 9½ × 6½, pp. xlii. and 364. *Presented by the Secretary of State for India.*

This is in a sense a continuation of the 'First Letter-book of the East India Company,' but the spelling of the original is modernized, except in the case of place-names, the modern spelling of which is given in brackets, and instead of notes on the text, a general introduction and glossary have been supplied. The letters are very interesting, full of adventures of the sea and of trade amongst the peoples of India and of the Malay Archipelago.

Educational. *Scottish G. Mag.* **12** (1896): 414-422, 522-528, 576-583. **Herbertson.**

Geographical Education. By Andrew J. Herbertson. Also separate Reprint. *Presented by the Author.*

Educational. *J. Manchester G.S.* **11**, 1895 (1896): 255-264. **Hewlett.**

The Position of Geography as a School Subject. By Mr. E. G. Hewlett.

Educational—Methods. *G.Z.* **2** (1896): 679-687. **Klaje.**

Die geographischen Lehraufgaben der beiden Tertien. Von Dr. H. Klaje.

Criticisms on the official syllabus for geographical teaching in German schools.

Educational—Text-books. ——

Longmans' Geographical Series. Book ii. The World for Junior Students (pp. viii. and 406); Book iii., The World for Senior Students (pp. viii. and 528); Book iv., The British Empire (pp. xii. and 284); Book v., A Primary Physical Geography. By John Thornton, M.A. (pp. viii. and 142). London: Longmans & Co

Size 7½ × 5¼. *Maps and Illustrations. Prices:* No. 2, 3*s.*; No. 3, 4*s.* 6*d.*; No. 4, 3*s.* 6*d.*; No. 5, 2*s. Presented by the Publishers.*

The general geographies, which are anonymous, are good examples of their kind, and are distinguished from most other English schoolbooks by the introduction of clear coloured maps printed with the text. An original feature in the little physical geography is an illustrated glossary.

French Colonies. **Fosses.**

L'immigration asiatique dans nos colonies. Par M. Castonnet des Fosses.—Congrès National des Sociétés Françaises de Géographie. 16e Session. Bordeaux, Août 1895. Compte Rendu. Bordeaux, 1896. Size 10 × 6½, pp. 236–247.

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Ice. *Bihang K. Svensk. Vetens.-Ak. Handl.* **21** (1895): 1–13. **Hamberg.**

Studien über Meereis und Gletschereis. Von Axel Hamberg. *With Plates.*

Studies on the formation and peculiarities of sea-water ice and glacier ice.

Lothaire Case.

Le Procès Lothaire à Bruxelles. Publié par la Société Antiesclavagiste de Belgique, 1896. Size 9½ × 6½, pp. 72.

The documents and speeches in the Lothaire appeal, heard at Brussels, against the decision of the Courts of the Congo Free State.

Mountaineering. *Annuaire Club Alpin Français* **22**, 1895 (1896): 552–556. **Marsy.**

Une ascension à Roche-Melon en 1588, d'après une relation de voyage du seigneur de Villamont. Par M. le comte de Marsy.

Navigation. **Wilson-Barker and Allingham.**

Navigation: Practical and Theoretical. By David Wilson-Barker and William Allingham. With numerous Illustrations and Examination Questions. London: Charles Griffin & Co., 1896. Size 7½ × 5, pp. xii. and 154. *Price* 3*s.* 6*d. Presented by the Publishers.*

Both the theory and practice of navigation are dealt with in a very thorough manner by the authors in this little book. It is a distinct improvement on works of the same class, published for the use of seamen, and will be of great service to persons who desire to make themselves thoroughly acquainted with the principles of navigation.

Ordnance Survey Maps. *J. Manchester G.S.* **11**, 1895 (1896): 217–231. **Crook.**

Report to the Manchester Geographical Society on the Sale and Distribution of Ordnance Survey Maps. By Mr. Henry T. Crook.

Petroleum—Distribution. **Mengeot.**

Du pétrole et de sa distribution géographique dans le monde. Par M. Albert Mengeot.—Congrès National des Sociétés Françaises de Géographie. 16e Session. Bordeaux, Août 1895. Compte Rendu. Bordeaux, 1896. Size 10 × 6½, pp. 334–353.

Seamanship. **Wilson-Barker.**

A Manual of Elementary Seamanship. By D. Wilson-Barker. London: C. Griffin & Co., 1896. Size 7½ × 5, pp. xii. and 120. *Illustrations. Price* 5*s. Presented by the Publishers.*

This is a thoroughly practical little book, designed as an introduction to the art for young officers in the merchant service, but likely also to be very useful to yachtsmen

The Wheel in Folklore. **Simpson.**

The Buddhist Praying-Wheel, a Collection of Material bearing upon the Symbolism of the Wheel and circular movements in Custom and Religious Ritual. By William Simpson. London: Macmillan & Co., 1896. Size 9½ × 6, pp. viii. and 304. *Illustrations. Price* 10*s. Presented by the Publishers.*

This is a book of great interest. The Buddhist praying-wheel is usually looked on as peculiar to Tibet, and its use almost always explained as a labour-saving contrivance. Mr. Simpson, starting from the Buddhist machines, traces the symbolism of the wheel through all countries, races, and religions, and shows that the Tibetan form of worship is only one form of expression of an almost universal symbolism, founded on the daily path of the sun. The references to points in religious ritual and folk-lore are of the most unexpected and even startling character.

Tree-myths. **Philpot.**

The Sacred Tree; or, the Tree in Religion and Myth. By Mrs. J. H. Philpot. London: Macmillan & Co., 1897. Size 9½ × 6, pp. xvi. and 180. *Illustration.* *Price 8s. 6d.* *Presented by the Publishers.*

The folk-lore of trees is collected in this little volume from the people of all lands and all times. The wideness of the distribution in time and space of some of the tree-myths cited is very remarkable, and the treatise is illustrated by numerous drawings of symbolic trees.

Tropical Diseases. *G.Z.* **2** (1896): 617–625. **Däubler.**

Die Tropenpathologie. Von Dr. Karl Däubler.

Submarine Navigations. *C. Rd.* **123** (1896): 860–863. **Leflaive.**

Étude théorique sur la plongée des sous marins. Mémoire de M. Leflaive.

A mathematical study of the movements of a submarine boat steered by several rudders in horizontal and vertical planes.

Zoological Gardens—List.

List of the Vertebrated Animals now or lately living in the Gardens of the Zoological Society of London. Ninth edition, 1896. London: Longmans & Co. Size 9 × 6, pp. xvi. and 724. *Illustrations.* *Presented by the Zoological Society.*

NEW MAPS.

By J. Coles, *Map Curator*, R.G.S.

ARCTIC REGIONS.

North Pole. **Supan**

Die Grenzen der unbekannten Polargebiete. Von A. Supan. Scale 1: 20,000,000 or 316 stat. miles to an inch. Petermann's 'Geogr. Mitteilungen,' Jahrgang 1897, Tafel 3. Justus Perthes, Gotha. *Presented by the Publisher.*

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This is Livraison II. of the geological map of Europe which is in course of preparation in conformity with a resolution passed by the International Geological Congress of 1881. The maps in the present issue contain South-Western France, Spain, Portugal, part of the African shores of the Mediterranean, part of Italy, and the Balearic islands, Corsica, Sardinia, and Sicily. This important map will be completed in 49 sheets, 11 of which are now published.

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Historical Atlas of Modern Europe from the Decline of the Roman Empire; comprising also maps of parts of Asia and of the New World connected with European History. Edited by Reginald Lane Poole, M.A., PH.D., Lecturer in Diplomatic in the University of Oxford. Part iv. Oxford: at the Clarendon Press; London, Edinburgh, and Glasgow: Henry Frowde; Edinburgh: W. & A. K. Johnston, 1897. *Price* 3*s.* 6*d. Presented by the Clarendon Press.*

This part contains: Map 1, The Roman Empire, *circ.* 350, by Professor Bury, LITT.D.; Map 20, England and Wales under the House of Lancaster, by James Tait, M.A.; Map 30, Ireland under the Early Tudors, by Robert Dunlop, M.A. Each map is accompanied by explanatory letterpress, and they are all very clearly drawn.

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Geologische Karte des Deutschen Reichs auf grund der unter Dr. C. Vogels Redaktion in Justus Perthes' Geograph. Anstalt ausgeführten Karte in 27 Blättern in 1 : 500,000 or 7·8 stat. miles to an inch. Bearbeitet von Dr. Richard Lepsius. Lieferung IX. Blatt 1 u. 2. Justus Perthes, Gotha. *Price* 3 *marks.*

Hull. **Bartholomew.**

New Plan of Hull from the Ordnance Survey. By John Bartholomew, F.R.G.S. Revised to date by Local Authorities. Scale 5·3 inches to a mile. London: W. H. Smith & Son. *Price* 1*s. Presented by Messrs. J. Bartholomew and Co.*

Spain. **Direccion general del Instituto Geográfico y Estadistico.**

Mapa Topografica de España. Scale 1 : 50,000 or 0·78 stat. mile to an inch. Sheets Nos.: 791, Chinchilla de Monte-Aragón; 792, Alpera; 817, Provincia de Albacete, Pétrola; 840, Bienservida; 842, Provincia de Albacete, Liétor; 843, Provincia de Albacete Hellín; 858, Provincia de Córdoba El Viso; 860, Fuencaliente; 861, Solana del Pino; 862, Santa Elena; 863, Aldeaquemada; 867, Provincia de Albacete Elche de la Sierra; 879, Provincia de Córdoba Fuenteorejuna; 880, Provincia de Córdoba Espiel; 881, Provincia de Córdoba, Villanueva de Córdoba; 882, Venta de Cardeña; 883, Virgen de la Cabeza; 884, Provincia de Jaén La Carolina. Dirección General del Instituto Geográfico y Estadistico, Madrid.

AFRICA.

Africa. **Service Géographique de l'Armée.**

Carte de l'Algérie. Scale 1 : 50,000 or 0·78 stat. mile to an inch. Fille No. 61, Marceau; 271, Lamoricière. Dressé, gravé et publié par le Service géographique de l'Armée, Paris. *Price* 1 *fr.* 50 *c. each sheet.*

Africa. **Service Géographique de l'Armée.**

Tunisie. Scale 1 : 200,000 or 3·1 stat. miles to an inch. Dressé, gravé et publié au Service Géographique de l'Armée, Paris. *Price* 70 *c.*

Africa. **Hassenstein.**

Das südliche Schoa und die nördlichen Gebiete der Galla und Somál. Nach den neuesten Forschungen entworfen und gezeichnet von Dr. B. Hassenstein. Scale 1 : 2,000,000 or 31·4 stat. miles to an inch. Petermann's 'Geogr. Mitteilungen,' Jahrgang 1897, Tafel 2. Justus Perthes, Gotha. *Presented by the Publisher.*

AMERICA.

America, Central. **Sapper.**

Vulkane in San Salvador und Südost-Guatemala. Nach eigenen Aufnahmen im Jahre 1895 gezeichnet von Dr. Carl Sapper. Scale 1 : 10,000 or 6·3 inches to a stat. mile. Petermann's 'Geogr. Mitteilungen,' Jahrgang 1897, Tafel 1. Justus Perthes, Gotha. *Presented by the Publisher.*

GENERAL.

The World. **Johnston.**

The Victoria Regina Atlas. Political, physical, and astronomical. Containing two hundred plates and complete Index. W. & A. K. Johnston: Edinburgh & London, 1897.

This atlas contains 200 sheets of maps, on which many plans of cities and ports are given on an enlarged scale. Its principal feature is the space which is devoted to the maps of the British Empire.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published at the Hydrographic Department, Admiralty, during November and December, 1896.

No.	Inches.	
2011	m = 12·0	Wales:—Holyhead harbour. 2*s.* 6*d.*
1954	m = 0·5	Scotland, north coast:—Thurso bay to the north Minch. 3*s.* 6*d.*
463	m = 6·0	Ports and anchorages in the gulf of Corinth:—Vostitza bay. 1*s.* 6*d.*
872	m = 0·33	Mediterranean:—Kalimno to Rhodes, including the gulfs of Kos, Doris, and Symi. 3*s.*
305	m = 0·25	Gulf of St. Lawrence:—Great Mecattina island to Pashasheeboo point. 2*s.* 6*d.*
2480	m = 0·18	North America, east coast:—Nantucket island to Great Egg harbour, including Long Island sound, and showing the approaches to New York. 2*s.* 6*d.*
1305	m = 6·0	Plans on the coast of Chile:—Port Teleahuano. 1*s.* 6*d.*
465	m = 2·5	Plans on the coast of Chile:—Conchali bay and Port Vilos. 1*s.* 6*d.*
467	m = 2·7	Plans on the coast of Chile:—Chipana bay. 1*s.* 6*d.*
2458	m = 0·24	Alaska:—Port Simpson to Port McArthur, including the inner channels and Prince of Wales island. 3*s.*
599	m = 0·14	Africa, west coast:—Sheet VI., Cape Verde to river Cacheo, including the river Gambia. 2*s.* 6*d.*
2201	m = var.	Plans in Sumatra:—Simalur island or Pulo Babi, Labuan-Bajau bay, Rubia island anchorage, Sabang bay. 1*s.* 6*d.*
2772	m = {1·0 / 2·85}	Eastern archipelago:—Anchorages in Gillolo (Halmaheira), Dodinga bay, Gurapien anchorage. 1*s.* 6*d.*
2718	m = {4·75 / 4·0}	Anchorages on the east coast of Celebes. Pagemana anchorage, Belanta road. 1*s.* 6*d.*
473	m = 4·15	Friendly islands:—Lifuka island, anchorage, and approaches. 1*s.* 6*d.*
1043		Gulf of Carpentaria, with Sir Edward Pellew group, and Wellesley islands:—Plan added, Duyfhen point anchorage.

Charts Cancelled.

No.	Cancelled by	No.
2011 Holyhead harbour.	New Chart. Holyhead harbour	2011
1954 Thurso to Cape Wrath.	New Chart. Thurso bay to the North Minch	1954
1600 Plan of Vostitza bay on this sheet.	New Chart. Ports and anchorages in the gulf of Corinth	463
1431 Esquimaux islands to Lake island.	New Chart. Great Mecattina island to Pashasheeboo point	305
305 Lake island to Pashasheeboo point.		

2480 Block island to Great Egg harbour.	New Chart. Nantucket island to Great Egg harbour, etc.	2480
1300 Plan of Vilos road on this sheet.	New Chart. Plans on the coast of Chile	465
1278 Plan of Chipana bay on this sheet.	New Chart. Chipana bay	467
599 Cape Verde to Cape Roxo.	New Chart. Cape Verde to river Cacheo	599
219 Plan of Saban bay on this sheet.	New Chart. Plans in Sumatra	2201
2421 Plan of Lefuka anchorage on this sheet.	New Chart. Lifuka island, anchorage and approaches	473

1939 Plan of channel north from Magdalena bay on this sheet.

Charts that have received Important Corrections.

No. 171, Index chart of Admiralty sailing directions. 1491, England, east coast:—Harwich harbour. 1237, Ireland, north coast:—Lough Larne with Larne harbour. 2330, Norway:—Svenöer to Koster islands. 2269, White sea:—Sheet 1: Cape Cherni to Sozonora mount. 2751, Spitzbergen. 2302. Gulf of Bothnia:—Sheet 7:—Tome point round the head of the gulf to Tauro. 2070, Turkey:—Saloniki bay. 2754, North America, east coast:—Long island sound, Sheet 1. 763, West India islands and Caribbean sea, Sheet 3. 1278, Chile:—Cape Paquica to Cape Lobos. 2324, North America, west coast:—Cape San Lucas to San Diego bay. 1922, British Columbia:—Fraser river and Burrard inlet. 2689, Vancouver island:—Haro and Rosario straits. 579, Vancouver island:—Strait of Georgia, Sheet 1. 582, Vancouver island:—Goletas channel to Quatsino sound. 646, Africa, east coast:—English river, bar, and harbour. 813, Ceylon, south coast:—Negombo on the west to Caratievoe on the east. 914, Ceylon:—Colombo harbour. 2760, Sumatra, west coast:—Acheh head to Tyingkok bay. 911, Anchorages between Borneo and New Guinea. 1271, Korea:—Fontina point to Linden point, etc. 1069, Australia, east coast:—Port Jackson. 1890, Australia, east coast:—Wooloomooloo and Farm Cove anchorages. 1670A, Australia, east coast:—Moreton bay. 447, Western approaches to Torres strait. 2421, Tonga or Friendly islands. (*J. D. Potter, agent.*)

United States Charts. **U.S. Hydrographic Office.**

No. 1574, Port Livingston and approaches to Dulce rivers. From a survey in 1896 by the officers of the U.S.S. *Dolphin*, Commander W. T. Burwell, U.S.N., commanding. *Price 75 cents.*—No. 1573, Hospital bight, Honduras bay (Amatique gulf), Guatemala. From a survey in 1896 by the officers of the U.S.S. *Dolphin*, Commander W. T. Burwell, U.S.N., commanding. *Price 50 cents.*—Pilot charts of the North Atlantic and North Pacific oceans for December, 1896, and January, 1897. U.S. Department of the Navy, Bureau of Navigation. Published at Washington, D.C., December, 1896, at the Hydrographic Office, Charles D. Sigsbee, commander U.S.N., Hydrographer. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Lapland, Novaya Zemlya, etc. **Pearson.**

Album containing 115 photographs taken during the voyage of the S.Y. *Saxon* to Russian Lapland, Kolguev, and Novaya Zemlya, May 24 to August 12, 1895. *Presented by Henry J. Pearson, Esq.*

This series of photographs contains views taken on the coasts of Norway, Russian Lapland, Kolguev island, and Novaya Zemlya. Many of these are of special interest as illustrating the scenery, and the dwellings of the Samoyeds. The value of these photographs has been added to by the careful manner in which Mr. Pearson has arranged and described them in the album.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.